CITY OF PHILOMATH
Wastewater System Facilities Plan,
Philomath, Oregon

November 2001 Sludge Survey Report
DEQ Approval Letter – November 2001 Sludge Survey Report
September 2002 Lagoon Leakage Test Report
August 2001 Mixing Zone Study Report

Appendix C

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS & PLANNERS

November 20, 2001

Mr. Jack Arendt
DEQ-Western Region
750 Front Street NE, Suite 120
Salem, OR 97301

RE: Philomath WWTP – South Lagoon Biosolids Survey
J.O. 960.3110.0

Dear Jack:

This letter and the attached supporting drawing are submitted on behalf of the City of Philomath and are intended to fulfill the requirements of Condition 1-C of Schedule B in the City's NPDES permit. This condition requires the City to perform a biosolids survey in the south lagoon (Cell #1). The remainder of this letter is divided into the following sections:

- Survey Methods.
- Survey Results and Discussion

Short discussions on these items follow.

Survey Methods.

Westech Engineering personnel performed a biosolids survey of the south lagoon on November 9, 2001. The survey was completed using a two-man crew in the boat and a surveyor on shore equipped with a total station. The sludge depth was measured at approximately 60 locations in the south lagoon. The highest concentration of survey points was taken in the immediate area around the inlet pipe coming from the Parshall flume. The remaining measurements were taken at representative locations around the lagoon to demonstrate the amount of sludge present in the lagoon. Personnel in the boat measured the depth from the water surface to both the top of the sludge blanket and floor of the lagoon at each location. The surveyor with the total station located on the shore of the lagoon determined the horizontal location of each sludge measurement point. Weather conditions during the survey period were dry with wind less than 5 mph.

Survey Results and Discussion.

The results of the sludge survey are as shown on the attached drawing. This drawing shows that there is a cone of sludge around the inlet pipe itself, but that the sludge depth decreases rapidly as the distance from the inlet pipe increases. This cone shaped sludge accumulation is typical of stabilization lagoons where the inlet pipe enters the lagoon in a vertical position. Review of the

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drawing shows that the accumulated depth of the sludge beyond about 75 feet from the inlet piping to be generally less than 0.5 feet in depth. The total volume of accumulated sludge in the lagoon is relatively small. Based upon our experience with other similar lagoon systems, we do not anticipate that the City will need to remove biosolids from the lagoons for at least 5-10 years.

The WWTP including the two stabilization lagoons was constructed in 1986. This is the first biosolids survey completed at the facility. The survey shows a relatively small accumulation of sludge around the inlet pipe which is typical. There is, however, very little accumulated sludge outside of the immediate area of the inlet pipe. Based upon the survey results and considering the survey represents 15 years of accumulated biosolids, there is little reason for the City to undertake an annual biosolids survey. Please consider this letter to be the City's formal request to change the frequency of the biosolids survey requirement from an annual occurrence to once each five (5) years as provided by Note 2 for Schedule B of the City's NPDES permit. The City requests that the Department provide a written response to this request within forty-five (45) days.

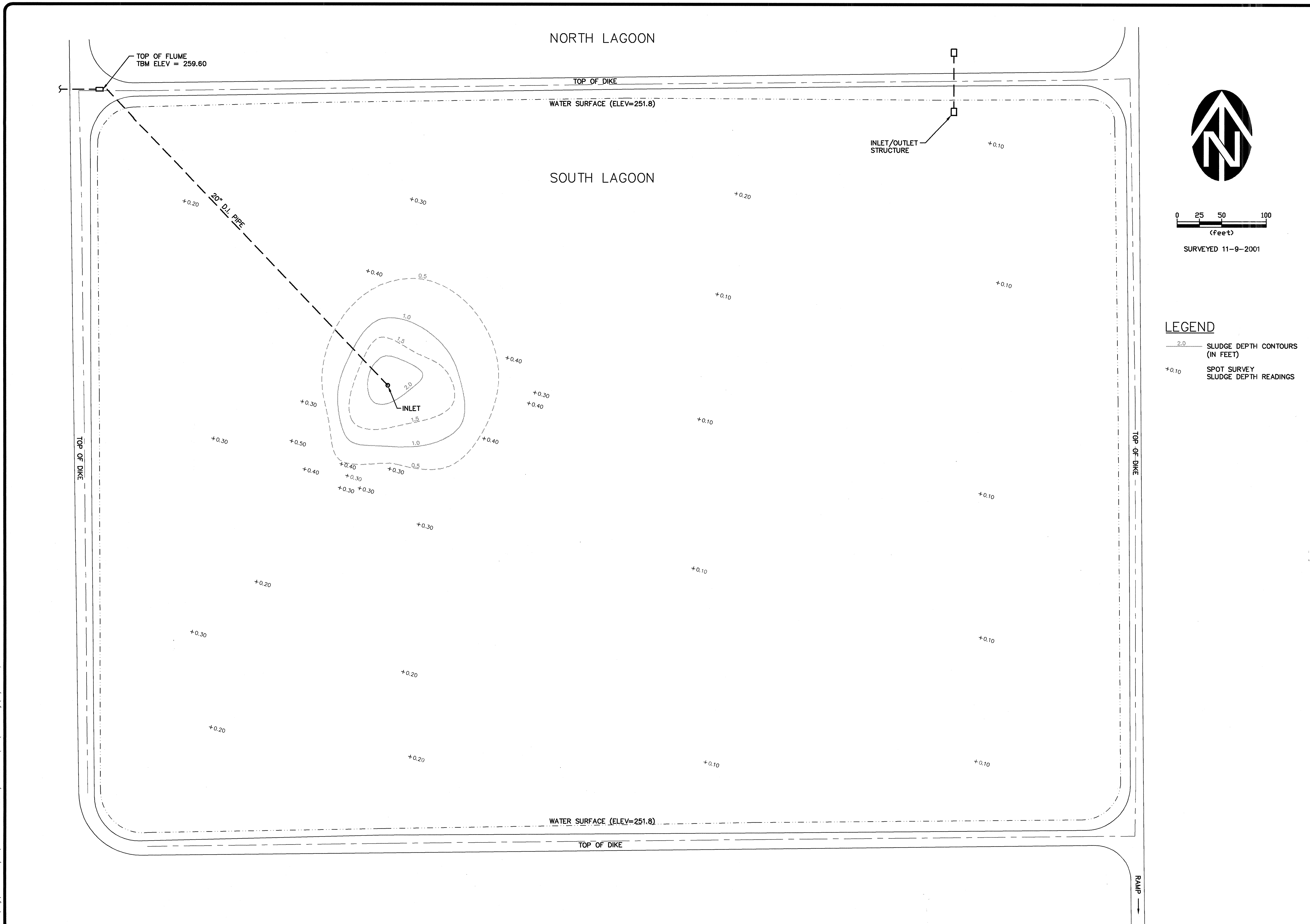
We hope this information is useful and that the Department now has sufficient information available to change the required frequency for the biosolids survey to five (5) years. Should you have questions regarding this letter, please do not hesitate to contact us at (503) 585-2474.

Sincerely,

WESTECH ENGINEERING, INC.

John L. Yarnall, P.E.

jly
enc.
cc: Mr. Beau Vencill, City of Philomath w/enc.



NO.	DATE	DESCRIPTION	BY
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REVISIONS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DSN.
DRN. TMT
CKD. JLY
DATE: NOV 2001

REGISTERED PROFESSIONAL ENGINEER #14,211 OREGON SEPT. 27, 1988 JOHN L. YARNALL
CERT. EXP. JUNE 30, 2002

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
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E-mail: westech@westech-eng.com

CITY OF PHILOMATH

WWTP – SOUTH LAGOON BIOSOLIDS SURVEY

SHEET 1 OF 1

JOB NUMBER 960.3110.0

Nov 14, 2001 – 11:11am
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WWTP sludge survey, 2001

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Western Region - Salem Office
750 Front St. NE, Ste. 120
Salem, OR 97301-1039
(503) 378-8240
(503) 378-3684 TTY

December 3, 2001

Mr. Beau Vencill
City of Philomath
PO Box 400
Philomath, OR 97370

RE: WQ-City of Philomath STP
File No. 103468
Benton County
MAO WQ/M-WR-00-144 Condition 8A(2)
Approval – South Lagoon Biosolids Survey

Dear Mr. Vencill;

The Oregon Department of Environmental Quality (Department) has completed its review of the above referenced analysis as required per NPDES Permit 102060, Schedule B, Condition 1,c, Note 2. The study was received at the Salem office on November 21, 2001, and was submitted by Westech Engineering, Inc. Consulting Engineers. The following is a brief description of the report:

- Survey methods
- Survey Results and Discussion

Based on the results of the study, the Department concurs with the report conclusions. In accordance with Schedule B, Condition 1,c, Note 2, subsequent sludge measurements will be done on 5-year intervals unless observations or other indications warrant more frequent measurements or removal of biosolids. Please don't hesitate to contact me if you have any questions or need further assistance at (503) 378-8240, extension 240.

Sincerely,

Jack Arendt, R.G.
Senior Hydrogeologist
Western Region-Salem Office

WESTECH
DEC 04 2001
RECEIVED

JJA:clp
x:\jarendt\Sludge depth-app.doc

cc: John Yarnall, P.E.
Westech Engineering, Inc.
3841 Fairview Industrial Drive S.E., Suite 100
Salem Oregon 97302

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS & PLANNERS

September 4, 2002

Mr. Beau Vencill
Public Works Superintendent
PO Box 400
Philomath, OR 97370

RE: Philomath – WWTP Lagoon Leakage Test Results
J.O. 960.3010.0

Dear Beau:

This letter report and attached supporting information summarizes the results of the recent leakage test for the north and south lagoons at the WWTP. The remainder of this letter report is divided into the following sections.

- Background Information.
- Procedure/Methods.
- Test Results.
- Recommendations.

Short discussions on these items follow.

Background Information.

The City owns, operates and maintains the wastewater treatment plant (WWTP) located south of town. The WWTP consists of a headworks, two stabilization lagoons each about 20 acres in size, and disinfection facilities. The WWTP was constructed in the summer of 1986 and operates largely as originally constructed. To the best of our knowledge, lagoon leakage tests have never been conducted with the exception of initial tests performed as part of the initial construction work.

The best lagoon leakage test results are obtained when the number of variables is kept to a minimum. Under ideal conditions, each lagoon cell is tested independently with no effluent either added or removed from the cell during the test. This was the approach used in Philomath. Each lagoon was tested independently by diverting all plant flows to the lagoon not being tested. No discharge from the plant occurred during the test.

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Procedures/Methods.

The leakage tests were conducted with Westech and City personnel on the lagoons starting August 14th and concluding September 3rd. As stated above, no influent was sent to the subject lagoon during the test. No treated wastewater was removed from the lagoons during the test.

Equipment used for the test is as summarized below.

▪ Rain gauge	Nova Lynx Model 260-2531 rain gauge.
▪ Class A Evaporation Pan	Nova Lynx Model 255-200
▪ Evaporation Pan Stilling Well	Nova Lynx Model 255-205
▪ Evaporation Pan Hook Gauge	Nova Lynx Model 255-214
▪ Lagoon Stilling Wells	10-inch PVC w/ internal steel rulers

Westech and City personnel set up the equipment. City WWTP operators took daily readings each day at approximately the same time. Westech personnel at the conclusion of the test period performed calculations and analysis. The water level in each of the lagoons was measured on a daily basis by reading the internally mounted steel rulers within the 10-inch PVC stilling wells mounted in the lagoons. The stilling wells in the lagoons are required to allow an accurate reading of the water surface elevation due to the presence of wind waves.

Precipitation during the test period for the north lagoon totaled 0.03 inches. There was no precipitation recorded during the test for the south lagoon. Because there was very little precipitation prior to and during the test, the dike soil and riprap was dry. For this reason, it was assumed that precipitation falling on the dike slope or roadway was adsorbed by soil and did not flow into the lagoons.

Evaporation was measured using a Class A evaporation pan on a wooden platform. A pan coefficient of 0.70 was used to determine the evaporation from the lagoons. A pan coefficient of 0.70 is at the lower end of the range for converting pan evaporation to lagoon evaporation. It was selected because of the relatively large size of the lagoons and because it results in the lowest evaporation rate (and thereby the highest seepage rate).

The average depth of the water in the lagoons during the test was approximately 4.5 feet. This is slightly lower than the average annual water level in the lagoons but is considered to be representative for testing purposes.

Test Results.

Table 1 shows the test data and calculated seepage rate for the North Lagoon. Review of the data shows that precipitation was recorded on only one day. Table 2 shows the test data and calculated seepage for the South Lagoon. The calculated average daily seepage rates from the north lagoon and the south lagoon are 0.049 inches and 0.011 inches respectively. This seepage rate is well below the Department of Environmental Quality's (DEQ) benchmark of 1/8" per day (0.125"/day) for sewage lagoons.

Recommendations.

Based upon the test results, the lagoons have a measured seepage rate well below the DEQ's benchmark of 0.125 inches per day. The testing to date verifies the adequacy of the existing natural lagoon liner, and no further leakage testing of the existing lagoons is warranted. The information obtained during the testing will be incorporated in the Facilities Plan.

Should you have any questions or need additional information regarding this matter, please contact us at (503) 585-2474.

Sincerely,

WESTECH ENGINEERING, INC.

John L. Yarnall, P.E.

jly
enc.

TABLE 1

CITY OF PHILOMATH
WWTP LAGOON LEAKAGE TEST REPORT FORM
NORTH LAGOON

Date	Time	Rainfall (inches)	Hook Gauge Reading (inches)	Amount of Water Added to Pan	Stilling Well Staff Gauge Reading (Inches)	Lagoon Water Depth (to nearest 0.02 ft)	Lagoon Evaporation coef. = 0.7 (inches)	Lagoon Level Change (inches)	Seepage (inches)
8/14/2002	11:25 AM	0	4.31	0	29 7/8	4.44	-	-	-
8/15/2002	10:00 AM	0	3.88	0	30 1/4	4.40	0.30	-0.38	0.07
8/16/2002	9:45 AM	0	3.52	0	30 5/8	4.38	0.25	-0.38	0.12
8/17/2002	10:11 AM	0	3.27	0	30 7/8	4.35	0.18	-0.25	0.08
8/18/2002	9:37 AM	0	2.90	0	31	4.33	0.26	-0.13	-0.13
8/19/2002	11:00 AM	0	2.62	0	31 3/8	4.31	0.20	-0.38	0.18
8/20/2002	11:00 AM	0.03	2.42	0	31 7/16	4.30	0.17	-0.06	-0.08
8/21/2002	10:00 AM	0	2.17	0	31 3/4	4.29	0.18	-0.31	0.14
8/22/2002	11:00 AM	0	2.01	0	31 7/8	4.27	0.11	-0.13	0.01
8/23/2002	11:50 AM	0	1.73	0	32 1/8	4.25	0.20	-0.25	0.05

Average Seepage (inches/day) = 0.049

1. No water was discharged from the lagoon during the test period.
2. No water was added to the lagoon during the test period.

TABLE 2

CITY OF PHILOMATH
WWTP LAGOON LEAKAGE TEST REPORT FORM
SOUTH LAGOON

Date	Time	Rainfall (inches)	Hook Gauge Reading (inches)	Amount of Water Added to Pan	Stilling Well Staff Gauge Reading (Inches)	Lagoon Water Depth (to nearest 0.02 ft)	Lagoon Evaporation coef. = 0.7 (inches)	Lagoon Level Change (inches)	Seepage (inches)
8/23/2002	12:00 PM	0	4.28	0	9 11/16	4.75	-	-	-
8/24/2002	12:00 PM	0	4.00	0	9 7/8	4.73	0.20	-0.19	-0.01
8/25/2002	10:40 AM	0	3.71	0	10 1/8	4.70	0.20	-0.25	0.05
8/26/2002	11:00 AM	0	3.55	0	10 1/4	4.70	0.11	-0.13	0.01
8/27/2002	10:45 AM	0	3.30	0	10 3/8	4.69	0.18	-0.13	-0.05
8/28/2002	11:40 AM	0	3.02	0	10 7/16	4.68	0.20	-0.06	-0.13
8/29/2002	11:00 AM	0	2.62	0	10 13/16	4.65	0.28	-0.38	0.10
8/30/2002	10:00 AM	0	2.33	0	11 1/8	4.64	0.20	-0.31	0.11
8/31/2002	8:45 AM	0	2.10	0	11 1/4	4.60	0.16	-0.13	-0.04
9/1/2002	9:24 AM	0	1.92	0	11 3/8	4.59	0.13	-0.13	0.00
9/2/2002	9:20 AM	0	1.61	0	11 1/2	4.58	0.22	-0.13	-0.09
9/3/2002	11:00 AM	0	1.33	0	11 7/8	4.57	0.20	-0.38	0.18

Average Seepage (inches/day) = 0.011

1. No water was discharged from the lagoon during the test period.
2. No water was added to the lagoon during the test period.

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS & PLANNERS

August 30, 2001

HAND DELIVERED

Mr. Jack Arendt
DEQ-Western Region
750 Front Street NE, Suite 120
Salem, OR 97301

RE: Philomath WWTP Outfall
J.O. 960.310.0

Dear Jack:

This letter report and attached supporting information is submitted on behalf of the City of Philomath and is intended to fulfill the requirements of Condition 8A(2) of the City's Mutual Agreement Order (MAO WQ/M-WR-00-144) with the Department. The remainder of this letter report is divided into the following sections:

- Background Information.
- Field Work.
- Model Conditions.
- Model Results and Analysis.
- Selected Alternative and Schedule.

Short discussions on these items follow.

Background Information.

Discharge of treated effluent from the City's wastewater treatment plant (WWTP) is governed by the City's NPDES permit #102060 which has an expiration date of November 30, 2005. The operation of the WWTP is also governed in part by the MAO between the City and the Department. Condition 8A(2) of the MAO states that "by no later than September 1, 2001, the Permittee shall have performed the modeling and analysis for making improvements to the wastewater treatment facilities to comply with the final chlorine effluent limitation included in the Permit". The final effluent chlorine residual limits included in Schedule A of the Permit are 0.08 mg/l and 0.03 mg/l for a maximum daily and monthly average respectively. The Permit does contain language that these limits may be modified based upon work performed under the MAO requirements. The field work, modeling, discussion and analysis performed by the City and as described herein address how the chlorine standards will be met.

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The WWTP was designed and continues to operate as a summer holding winter discharge facility. Discharge of treated effluent to the Marys River is permitted November 1st through April 30th of each winter. No discharge to surface waters is permitted during the summer months. The WWTP includes two stabilization lagoons with a total water surface area of about 38 acres. The lagoons provide both treatment and storage of wastewater. Treated effluent is discharged to the Marys River through a 16-inch diameter ductile iron pipe with a single discharge port.

Like smaller unregulated rivers in the Willamette Valley, stream flow in the Marys River is very rainfall dependent. Stream flow is typically lowest during the early fall prior to the return of the winter rains. From a stream water quality standpoint, the worst case scenario occurs when the flow in the Marys River is low and the discharge rate from the WWTP is high. This case is most likely to occur during the month of November during a "dry" fall with below normal precipitation. The City performed stream flow measurements in early 1999 when the river was flowing about 780 cubic feet per second (cfs). Computer modeling using the CORMIX model was done at an assumed river flow of 450 cfs. This analysis showed the existing outfall with a discharge rate of 2.75 millions of gallons per day (mgd) and a chlorine residual of 0.5 mg/l did not satisfy the EPA limits for both acute and chronic toxicity (0.019 mg/l and 0.011 mg/l respectively). The analysis recommended additional field and modeling work be done at lower stream flow rates to determine if a multi-port diffuser together with a reduction in the chlorine residual could meet water quality standards under the low stream flow/high discharge rate scenario. The DEQ used this analysis together with their own modeling efforts as the basis for the MAO.

Data Collection and Field Work.

City and Westech personnel collected data used for computer modeling. Data sources utilized included the City's Discharge Monitoring Reports for the WWTP and Marys River pH and temperature as measured at the City's Water Treatment Plant intake (about 1 mile upstream of the WWTP outfall). Stream flow measurements, cross sections and velocity profiles were performed on March 20th and 28th of this year when the flows were estimated to be 330 and 450 cfs respectively. The cross sections, velocity profiles and photos are attached at the end of this letter report.

Model Conditions.

The computer model CORMIX was used to analyze the dilution achieved within the mixing zone. Cornell University developed CORMIX for the U.S. Environmental Protection Agency (EPA). CORMIX is an expert system that examines the hydrodynamic mixing of submerged discharges.

The CORMIX model uses several hydraulic parameters in calculating the effluent plume and corresponding dilution that result from a discharge to a receiving stream. The input parameters required include the following:

- Regulatory requirements including the standards for toxic substances and the regulatory mixing zone (RMZ).
- Receiving stream data including stream flow, temperature, and channel characteristics and effluent data including flow, temperature, and expected concentrations for pollutants of interest.
- Discharge design including port location, orientation, and size.

Regulatory Requirements

Regulatory requirements include standards for toxic substances like chlorine and ammonia, as well as the permitted RMZ.

Standards for Toxic Substances

The two toxic substances of concern for this mixing zone analysis are chlorine and ammonia. Standards for chlorine toxicity are included in the Oregon Administrative Rules Chapter 340 (OAR 340) Division 41. Standards for ammonia toxicity are regulated by the EPA and defined in the "Quality Criteria for Water 1986". Table 1 summarizes the standards for these substances. Concentration standards are shown in milligrams per liter (mg/l).

The EPA regulates the concentration of ammonia in receiving streams because of the toxicity of ammonia to fish. The EPA limits for ammonia concentrations are defined as acute toxicity, or one-hour average concentrations, and chronic toxicity, or four-day average concentrations. These limits depend on the temperature and pH of the receiving stream and whether or not salmonids are present in the stream. As stream temperature increases and as stream pH increases, ammonia concentration limits become more stringent. The worst-case condition for these parameters is believed to exist in early November. Table 1 shows the assumptions made with respect to the river for the development of the ammonia standards to be used in this analysis. These assumptions are based on City collected data and STORET data on the Mary's River provided by DEQ.

TABLE 1
TOXIC SUBSTANCE STANDARDS

Substance	Stream Temperature	Stream pH	Salmonids Present	Standards (mg/l)	
				Acute	Chronic
Chlorine	-	-	-	0.019	0.011
Ammonia	12 degrees C	7.5	YES	14.9	2.2

Mixing Zone

The RMZ for the City of Philomath discharge defines the zone within which chronic standards must be met. The RMZ is described in the current NPDES permit as the portion of the Mary's River not to exceed 100 feet downstream to 10 feet upstream and a width of 20 feet from the point of discharge. The zone of initial dilution (ZID) is often defined as 10 percent of the RMZ, or 10 feet downstream of the point of discharge based on the Philomath RMZ. The ZID represents the zone within which acute standards must be met.

River and Effluent Data

The river and effluent data used for the mixing zone analysis and the basis for this data are shown in Table 2 and in attached Spreadsheets 1-6. Flows are shown in cfs and mgd and velocities are shown in feet per second (fps).

It must be noted that mixing zone analyses typically consider the 7-day duration, 10-year frequency low flow (7Q10 low flow) stream flow for the worst-case design conditions. For this analysis, however, the 7Q10 low flow was not used because the 7Q10 low flow occurs in August when no discharge is allowed. The lowest stream flow conditions during the discharge period are most likely to occur during November and prior to the return of normal winter precipitation. Under these conditions, the 7Q10 is estimated to be slightly less than 20 cfs. This condition, however, is also not representative because it is DEQ's policy to request that WWTPs **not** discharge until the rains return and stream flow increases. The DEQ has done this at least once within the past 10 years, and the City complied with the request. It is important to note that the WWTP can continue to store effluent without discharging in such conditions because sanitary flows remain essentially constant, I/I flows are at their minimum and there is very little precipitation on the lagoons themselves. For the above reasons, the mixing zone analysis was based on conditions at or below average November flows (330 and 450 cfs), as indicated in Table 2.

TABLE 2
MARY'S RIVER AND WWTP EFFLUENT DATA

Parameter	Analysis Data (3/28/01)	Analysis Data (3/20/01)	Basis for Analysis Data
Mary's River Flow	450 cfs	330 cfs	450 cfs is the mean flow for the month of November. (1)
Mary's River Water Level	235.6'	234.2'	Approximation based on river flow. (2)
Mary's River Water Depth	5.3 feet	4.6 feet	Approximation based on river flow and water level. (3)
Mary's River Width	57 feet	54 feet	Approximation based on river flow and water level. (3)
Mary's River Velocity	1.5 fps	1.3 fps	Based on river flow, water level, water depth, and width. (4).
Mary's River Temperature	12 degrees C	12 degrees C	Difference between the river and effluent temperatures was assumed at 2 deg C (see effluent temperature below).
WWTP Effluent Flow	2.75 mgd	2.75 mgd	Capacity of the chlorine contact facility at the WWTP assuming 30 minutes contact time.
WWTP Effluent Temperature	14 degrees C	14 degrees C	Maximum assumed effluent temperature during November. (5)
WWTP Effluent Chlorine Residual	1.2 mg/l	1.2 mg/l	Maximum effluent chlorine residual. The average chlorine residual is ±0.40 mg/l. (5)
WWTP Effluent Ammonia Concentration	20 mg/l	20 mg/l	Maximum ammonia concentration out of the lagoons. Average ammonia concentration is ±10.4 mg/l

1) From U.S. Geological Survey (USGS) Statistical Summaries of Stream flow Data in Oregon from 1941-1982 for the Mary's River near Philomath, OR, at River Mile 9.4, approximately one mile downstream of the Philomath outfall discharge point.
2) From field elevation measurements taken in March 2001 on the dates the stream flow measurements were taken.
3) From profile conducted for this analysis in March 2001. See the attached stream cross section and velocity profile information.
4) From CORMIX output.
5) From the 1999-2002 and 2000-2001 discharge season WWTP daily monitoring reports (DMRs).

Model Results and Analysis.

Model Results

CORMIX model results for the existing outfall configuration at both 330 and 450 cfs with varying chlorine residual and effluent ammonia concentrations are shown on Spreadsheets 1 and 2. These spreadsheets assume that the discharge rate from the WWTP is 2.75 mgd. Review of Spreadsheets 1 and 2 shows that ammonia limits are satisfied, but that chlorine limits for both acute and chronic toxicity are not met unless the chlorine residual is 0.05 mg/l. It is not feasible to achieve this chlorine residual and meet the E. coli limits unless the effluent is dechlorinated prior to discharge to the Marys River. In summary, discharge through the existing outfall configuration is not feasible under lower stream flow conditions unless the effluent is dechlorinated prior to discharge.

The use of a multi-port diffuser is a common method to enhance mixing. Spreadsheets 3 and 4 show the CORMIX model results under differing conditions assuming a discharge rate of 2.75 mgd and a stream flow of 330 cfs. Spreadsheet 3 assumes a 3-port diffuser while Spreadsheet 4 assumes that a 4-port diffuser will be used. Spreadsheet 5 is also based upon a stream flow of 330 cfs and a 3-port diffuser, but it assumes that the discharge rate from the WWTP is 1.0 mgd. The model results with differing ammonia concentrations and chlorine residuals are illustrated on Spreadsheets 3, 4 and 5. Review of the spreadsheets shows that ammonia does not present a problem under all conditions including effluent concentrations up to 20 mg/l. A review of the chlorine values, however, shows that acute chlorine toxicity remains a problem within the ZID for all chlorine residuals of 0.2 mg/l or greater including Spreadsheet 5 where the discharge rate was reduced to 1.0 mgd. The chlorine limits are met in all cases if the chlorine residual is 0.05 mg/l. The spreadsheets illustrate that the chlorine limits can not be realistically met using a multi-port diffuser under an assumed stream flow rate of 330 cfs unless the effluent is dechlorinated prior to discharge.

Spreadsheet 6 shows the CORMIX model results with a stream flow of 450 cfs and a 3-port diffuser. This spreadsheet assumes a discharge rate of 2.75 mgd from the WWTP. Review of the spreadsheet again shows that the ammonia limits are met, but that chlorine toxicity within the ZID remains a problem at chlorine residuals of 0.2 mg/l or greater.

Discussion

The CORMIX model results demonstrate that the existing outfall will satisfy ammonia limits under low stream flow conditions (330 cfs), but that chlorine limits will not be met. The model results also show that the installation of a multi-port diffuser alone will not result in satisfactory

chlorine limits within the ZID under low stream flow conditions. If the treated effluent is dechlorinated prior to discharge such that the remaining chlorine residual is 0.05 mg/l or less, both chlorine and ammonia limits are met including with the existing single port outfall configuration.

The City desires to continue to discharge treated wastewater to the Marys River during the winter discharge season. Two potential alternatives exist to satisfy the chlorine toxicity requirements and fulfill the requirements as outlined in the MAO. The first alternative is to dechlorinate the effluent prior to discharge to the river. This technology is well established, would allow the existing outfall configuration to remain in its present configuration and would satisfy the chlorine toxicity requirements. Because of the relatively uniform discharge rate from the lagoons within a 24-hour period, the dechlorination system could be relatively simple. Under the dechlorination alternative, it is expected that discharge of treated wastewater could continue with little change from present operations. The second alternative would be operationally more complex and require close coordination with the Department to establish operating parameters. It would involve the installation of a multi-port diffuser with small diameter ports to enhance jet velocity into the river and only discharging under high stream flow conditions. The effluent chlorine residual would have to be closely managed to lower values than the City presently employs. Additionally, discharge from the WWTP under very high stream flow conditions would likely be restricted because of the reduced difference in water surface elevations between the water in the chorine contact chamber and the river. The reduced difference in water surface elevations would leave little available head to "force" effluent through the jets of the diffuser. Installation of the multi-port diffuser into the river would require an extensive and lengthy permitting process with local, state and federal agencies.

Selected Alternative and Schedule.

The City reviewed and discussed the two alternatives outlined above and decided to proceed with the dechlorination alternative. It is the City's intent to dechlorinate treated wastewater prior to discharge to the Marys River as the means to satisfy chlorine toxicity requirements. The existing single port outfall into the stream will remain in its present configuration. No work will be performed within the stream and as such no special permitting from the regulatory agencies for in-stream work is anticipated.

The City proposes to implement the dechlorination improvements within the schedule outlined in the MAO and as shown below in Table 3.

TABLE 3
PROPOSED IMPLEMENTATION SCHEDULE

Milestone	**MAO Latest Completion Date**
DEQ Acceptance of this Letter Report	September 30, 2001
Draft Engineering Plans & Specs. to DEQ	January 30, 2002
Final Engineering Plans & Specs. to DEQ	April 30, 2002
Construction Improvements Complete	September 30, 2003
All Work Complete. WWTP in Compliance with NPDES Permit.	November 30, 2003

We hope this information is useful and demonstrates the City's commitment to improve its WWTP and protect water quality. Should you have questions regarding this letter report, please do not hesitate to contact us at (503) 585-2474.

Sincerely,

WESTECH ENGINEERING, INC.

John L. Yarnall, P.E.

jly
enc.
cc: Mr. Beau Vencill, City of Philomath w/enc.

SPREADSHEET NO. 1

CITY OF PHILOMATH
MIXING ZONE ANALYSIS

CORMIX Results — Model File: PhExist330.cmx

Run Conditions:
- Existing outfall configuration
- Streamflow of 330 cfs (model calculates average velocity of 1.3 fps)
- Effluent flow rate of 2.75 mgd
- River temperature of 12 deg C and effluent temperature of 14 deg C

Distance from Outfall	Regulatory Zone	CORMIX Dilution *	Effluent Ammonia Conc. (mg/l)				Chlorine Residual Conc. (mg/l)				
				8 mg/l	12 mg/l	20 mg/l		0.05 mg/l	0.2 mg/l	0.5 mg/l	1.2 mg/l
0 ft		1.0		8.0	12.0	20.0		0.050	0.200	0.500	1.200
10 ft	ZID	2.9		2.8	4.1	6.9		0.017	0.069	0.172	0.414
50 ft		7.9		1.0	1.5	2.5		0.006	0.025	0.063	0.152
100 ft	RMZ	11.9		0.7	1.0	1.7		0.004	0.017	0.042	0.101
200 ft		32.4		0.2	0.4	0.6		0.002	0.006	0.015	0.037
Meets ZID Requirement?			14.9 mg/l	YES	YES	YES	.019 mg/l	YES	NO	NO	NO
Meets RMZ Requirement?			2.2 mg/l	YES	YES	YES	.011 mg/l	YES	NO	NO	NO

* CORMIX calculates dilution along the centerline of the plume and is the most conservation measurement within the plume.

SPREADSHEET NO. 2

CITY OF PHILOMATH											
MIXING ZONE ANALYSIS											
CORMIX Results		Model File: PhExist450.cmx									
Run Conditions:		Existing outfall configuration									
		Streamflow of 450 cfs (model calculates average velocity of 1.5 fps)									
		Effluent flow rate of 2.75 mgd									
		River temperature of 12 deg C and effluent temperature of 14 deg C									
				Effluent Ammonia Conc. (mg/l)				Chlorine Residual Conc. (mg/l)			
Distance	Regulatory	CORMIX									
from Outfall	Zone	Dilution *		8 mg/l	12 mg/l	20 mg/l		0.05 mg/l	0.2 mg/l	0.5 mg/l	1.2 mg/l
0 ft		1.0		8.0	12.0	20.0		0.050	0.200	0.500	1.200
10 ft	ZID	2.8		2.9	4.3	7.1		0.018	0.071	0.179	0.429
50 ft		7.4		1.1	1.6	2.7		0.007	0.027	0.068	0.162
100 ft	RMZ	11.0		0.7	1.1	1.8		0.005	0.018	0.045	0.109
200 ft		16.4		0.5	0.7	1.2		0.003	0.012	0.030	0.073
Meets ZID Requirement?			14.9 mg/l	YES	YES	YES	.019 mg/l	YES	NO	NO	NO
Meets RMZ Requirement?			2.2 mg/l	YES	YES	YES	.011 mg/l	YES	NO	NO	NO
* CORMIX calculates dilution along the centerline of the plume and is the most conservation measurement within the plume.											

SPREADSHEET NO. 3

CITY OF PHILOMATH
MIXING ZONE ANALYSIS

CORMIX Results — Model File: PhMulti3-330.cmx

Run Conditions:
- New outfall configuration with 3-port (each 6-inch) 9-foot diffuser added to end of existing outfall
- Streamflow of 330 cfs (model calculates average velocity of 1.3 fps)
- Effluent flow rate of 2.75 mgd
- River temperature of 12 deg C and effluent temperature of 14 deg C

Distance from Outfall	Regulatory Zone	CORMIX Dilution *	Effluent Ammonia Conc. (mg/l)				Chlorine Residual Conc. (mg/l)				
				8 mg/l	12 mg/l	20 mg/l		0.05 mg/l	0.2 mg/l	0.5 mg/l	1.2 mg/l
0 ft		1.0		8.0	12.0	20.0		0.050	0.200	0.500	1.200
10 ft	ZID	3.2		2.5	3.8	6.3		0.016	0.063	0.156	0.375
50 ft		17.3		0.5	0.7	1.2		0.003	0.012	0.029	0.069
100 ft	RMZ	32.4		0.2	0.4	0.6		0.002	0.006	0.015	0.037
200 ft		39.8		0.2	0.3	0.5		0.001	0.005	0.013	0.030
Meets ZID Requirement?			14.9 mg/l	YES	YES	YES	.019 mg/l	YES	NO	NO	NO
Meets RMZ Requirement?			2.2 mg/l	YES	YES	YES	.011 mg/l	YES	YES	NO	NO

* CORMIX calculates dilution along the centerline of the plume and is the most conservation measurement within the plume.

SPREADSHEET NO. 4

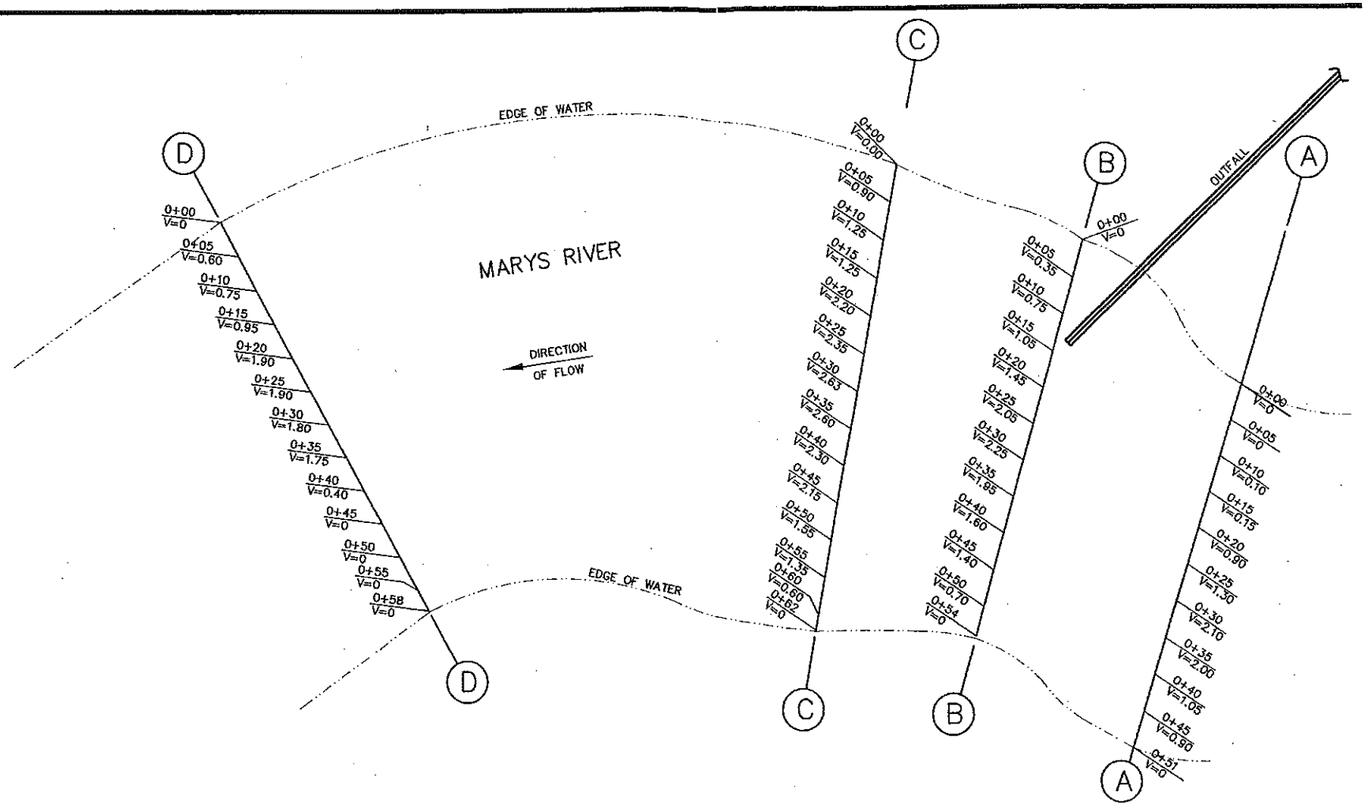
CITY OF PHILOMATH											
MIXING ZONE ANALYSIS											
CORMIX Results		Model File: PhMulti4-330.cmx									
Run Conditions:		New outfall configuration with 4-port (each 6-inch) 12-foot diffuser added to end of existing outfall									
		Streamflow of 330 cfs (model calculates average velocity of 1.3 fps)									
		Effluent flow rate of 2.75 mgd									
		River temperature of 12 deg C and effluent temperature of 14 deg C									
			Effluent Ammonia Conc. (mg/l)				Chlorine Residual Conc. (mg/l)				
Distance	Regulatory	CORMIX									
from Outfall	Zone	Dilution *		8 mg/l	12 mg/l	20 mg/l		0.05 mg/l	0.2 mg/l	0.5 mg/l	1.2 mg/l
0 ft		1.0		8.0	12.0	20.0		0.050	0.200	0.500	1.200
10 ft	ZID	2.9		2.8	4.1	6.9		0.017	0.069	0.172	0.414
50 ft		14.7		0.5	0.8	1.4		0.003	0.014	0.034	0.082
100 ft	RMZ	24.8		0.3	0.5	0.8		0.002	0.008	0.020	0.048
200 ft		32.5		0.2	0.4	0.6		0.002	0.006	0.015	0.037
Meets ZID Requirement?			14.9 mg/l	YES	YES	YES	.019 mg/l	YES	NO	NO	NO
Meets RMZ Requirement?			2.2 mg/l	YES	YES	YES	.011 mg/l	YES	YES	NO	NO
* CORMIX calculates dilution along the centerline of the plume and is the most conservation measurement within the plume.											

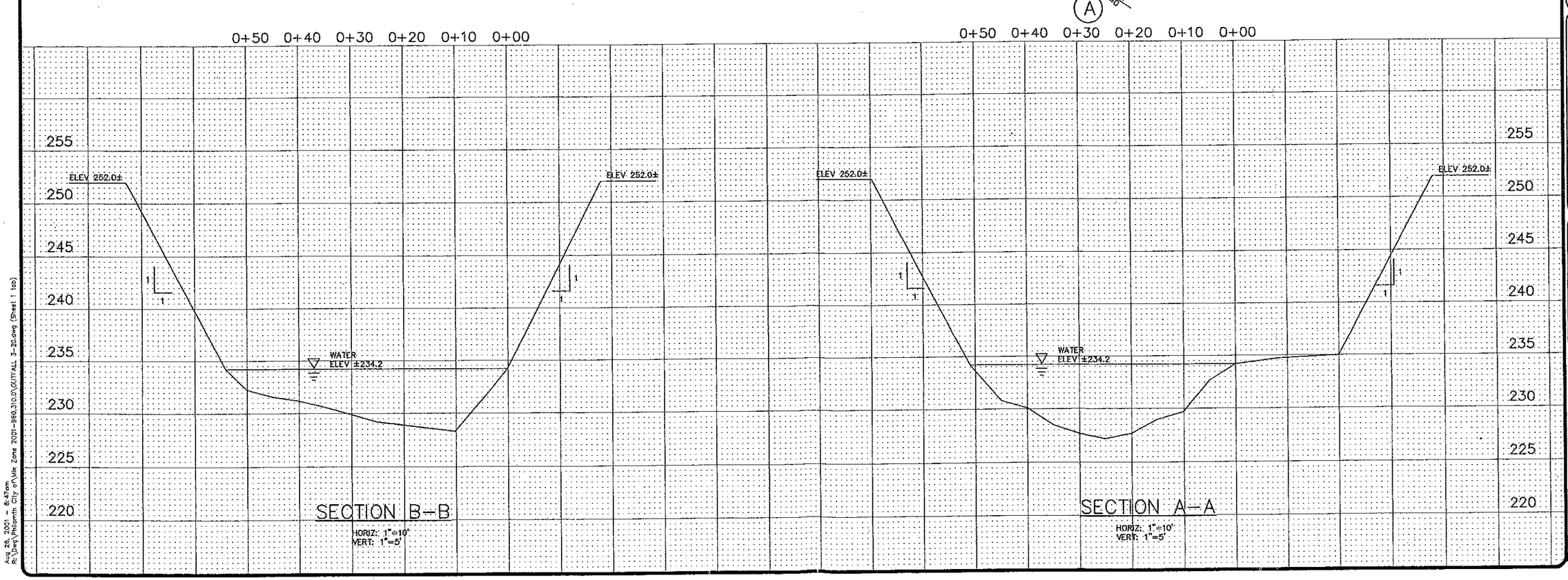
SPREADSHEET NO. 5

CITY OF PHILOMATH											
MIXING ZONE ANALYSIS											
CORMIX Results		Model File: PhMulti3-330a.cmx									
Run Conditions:		New outfall configuration with 3-port (each 6-inch) 9-foot diffuser added to end of existing outfall									
		Streamflow of 330 cfs (model calculates average velocity of 1.3 fps)									
		Effluent flow rate of 1.00 mgd									
		River temperature of 12 deg C and effluent temperature of 14 deg C									
			Effluent Ammonia Conc. (mg/l)				Chlorine Residual Conc. (mg/l)				
Distance	Regulatory	CORMIX									
from Outfall	Zone	Dilution *		8 mg/l	12 mg/l	20 mg/l		0.05 mg/l	0.2 mg/l	0.5 mg/l	1.2 mg/l
0 ft		1.0		8.0	12.0	20.0		0.050	0.200	0.500	1.200
10 ft	ZID	2.7		3.0	4.4	7.4		0.019	0.074	0.185	0.444
50 ft		46.8		0.2	0.3	0.4		0.001	0.004	0.011	0.026
100 ft	RMZ	88.3		0.1	0.1	0.2		0.001	0.002	0.006	0.014
200 ft		109.3		0.1	0.1	0.2		0.000	0.002	0.005	0.011
Meets ZID Requirement?			14.9 mg/l	YES	YES	YES	.019 mg/l	YES	NO	NO	NO
Meets RMZ Requirement?			2.2 mg/l	YES	YES	YES	.011 mg/l	YES	YES	YES	YES
* CORMIX calculates dilution along the centerline of the plume and is the most conservation measurement within the plume.											

SPREADSHEET NO. 6

CITY OF PHILOMATH											
MIXING ZONE ANALYSIS											
CORMIX Results		Model File: PhMulti3-450.cmx									
Run Conditions:		New outfall configuration with 3-port (each 6-inch) 9-foot diffuser added to end of existing outfall									
		Streamflow of 450 cfs (model calculates average velocity of 1.5 fps)									
		Effluent flow rate of 2.75 mgd									
		River temperature of 12 deg C and effluent temperature of 14 deg C									
			Effluent Ammonia Conc. (mg/l)				Chlorine Residual Conc. (mg/l)				
Distance	Regulatory	CORMIX									
from Outfall	Zone	Dilution *		8 mg/l	12 mg/l	20 mg/l		0.05 mg/l	0.2 mg/l	0.5 mg/l	1.2 mg/l
0 ft		1.0		8.0	12.0	20.0		0.050	0.200	0.500	1.200
10 ft	ZID	3.1		2.6	3.9	6.5		0.016	0.065	0.161	0.387
50 ft		19.9		0.4	0.6	1.0		0.003	0.010	0.025	0.060
100 ft	RMZ	35.3		0.2	0.3	0.6		0.001	0.006	0.014	0.034
200 ft		42.6		0.2	0.3	0.5		0.001	0.005	0.012	0.028
Meets ZID Requirement?			14.9 mg/l	YES	YES	YES	.019 mg/l	YES	NO	NO	NO
Meets RMZ Requirement?			2.2 mg/l	YES	YES	YES	.011 mg/l	YES	YES	NO	NO
* CORMIX calculates dilution along the centerline of the plume and is the most conservation measurement within the plume.											





0 5 10 20
(feet)

FIELD DATA TAKEN MARCH 20, 2001
STREAM FLOW ±330 CFS

ALL VELOCITIES ARE IN FEET PER SECOND
ALL ELEVATIONS ARE IN FEET ABOVE MSL

NO.	DATE	DESCRIPTION	BY
1		REVISIONS	

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DSN.
DRN. TMT
CKD. JLY
DATE AUG 2001

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 27, 1993
JOHN L. YARMEN
#14421
EXPIRATION DATE: JUNE 30, 2002

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com

CITY OF PHILOMATH
WWTP OUTFALL
MARYS RIVER
MIXING ZONE STUDY
MARCH 20, 2001 DATA

SHEET 1 OF 2

JOB NUMBER 960.310.0

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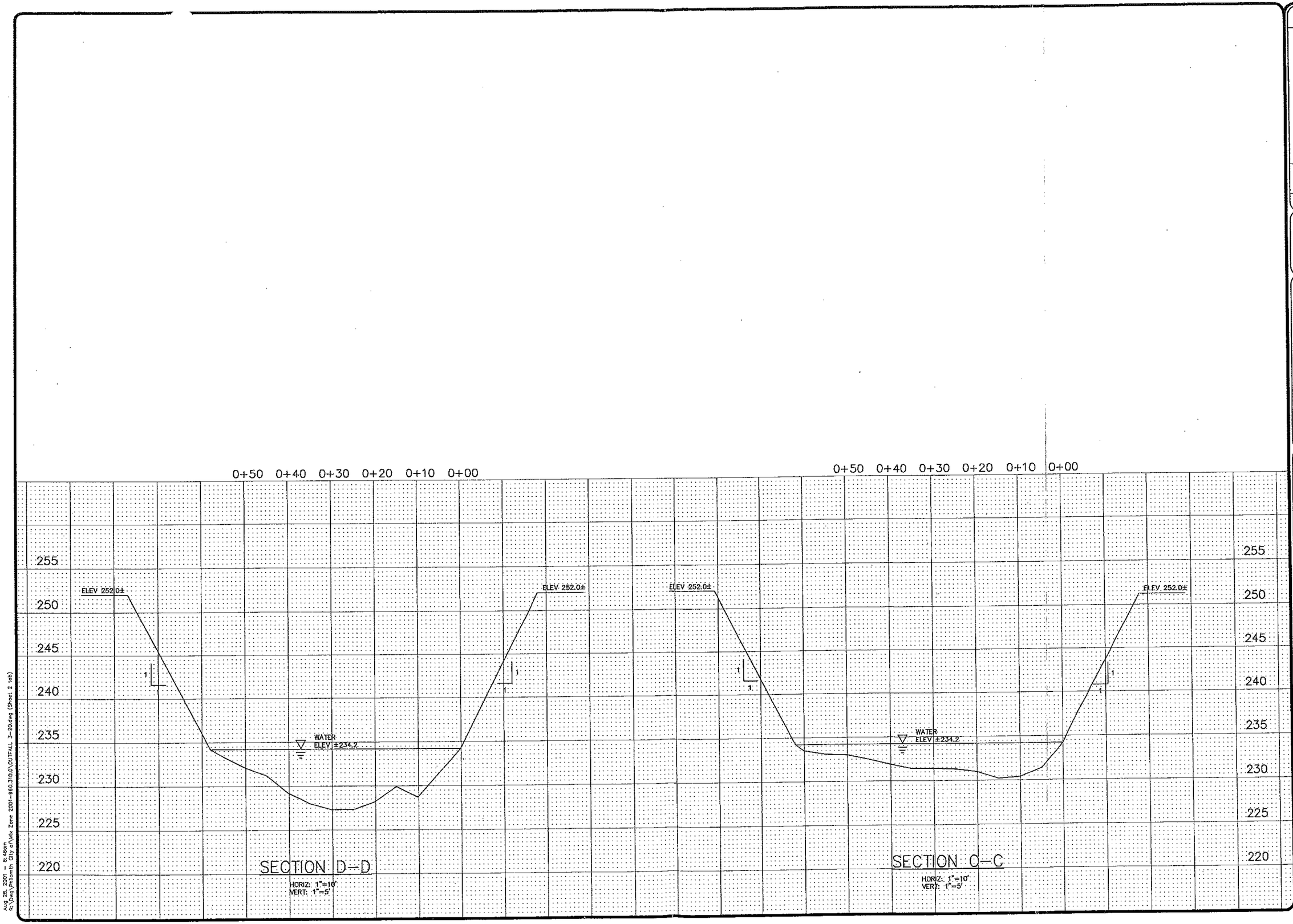

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IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY
0 1"

NO.	DATE	DESCRIPTION	BY
1		REVISIONS	

DSN. TMT
DRN. TMT
CKD. JLY
DATE AUG 2001

REGISTERED PROFESSIONAL ENGINEER
OREGON JULY 27, 1982
JULIAN L. YARNELL
#14211
EXPIRES: JUNE 30, 2002

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
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E-mail: westech@westech-eng.com

CITY OF PHILOMATH
WWTP OUTFALL

MARYS RIVER MIXING ZONE STUDY MARCH 20, 2001 DATA

SHEET 2 OF 2

JOB NUMBER 960.310.0

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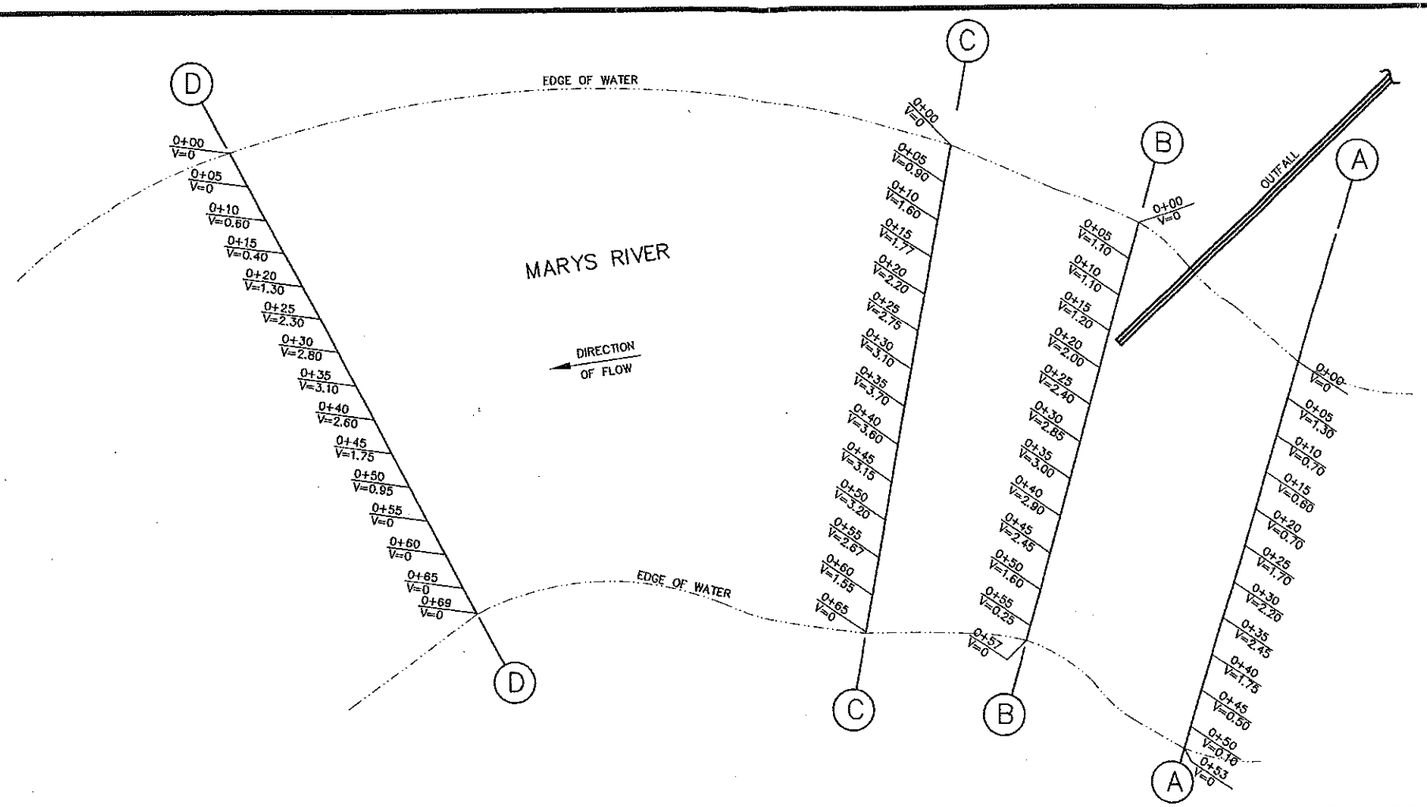
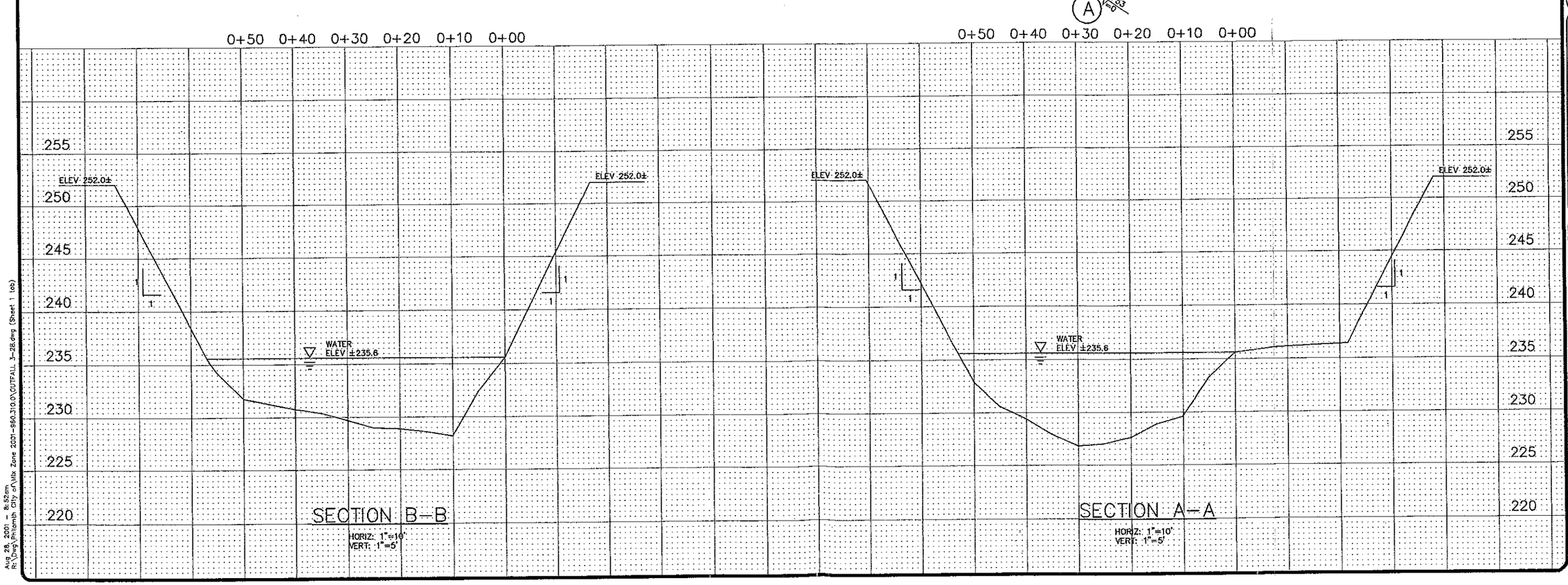


FIELD DATA TAKEN MARCH 28, 2001
STREAM FLOW ±450 CFS

ALL VELOCITIES ARE IN FEET PER SECOND
ALL ELEVATIONS ARE IN FEET ABOVE MSL



NO.	DATE	DESCRIPTION	BY
1		REVISIONS	

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DSN. THAT
DRN. THAT
CKD. JLY
DATE: AUG 2001

OREGON REGISTERED PROFESSIONAL ENGINEER #14,221 THOMAS A. HANSEN
EXPIRES: JUNE 30, 2002

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
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CITY OF PHILOMATH
WWTP OUTFALL
MARYS RIVER
MIXING ZONE STUDY
MARCH 28, 2001 DATA

SHEET 1 OF 2

JOB NUMBER 960.310.0

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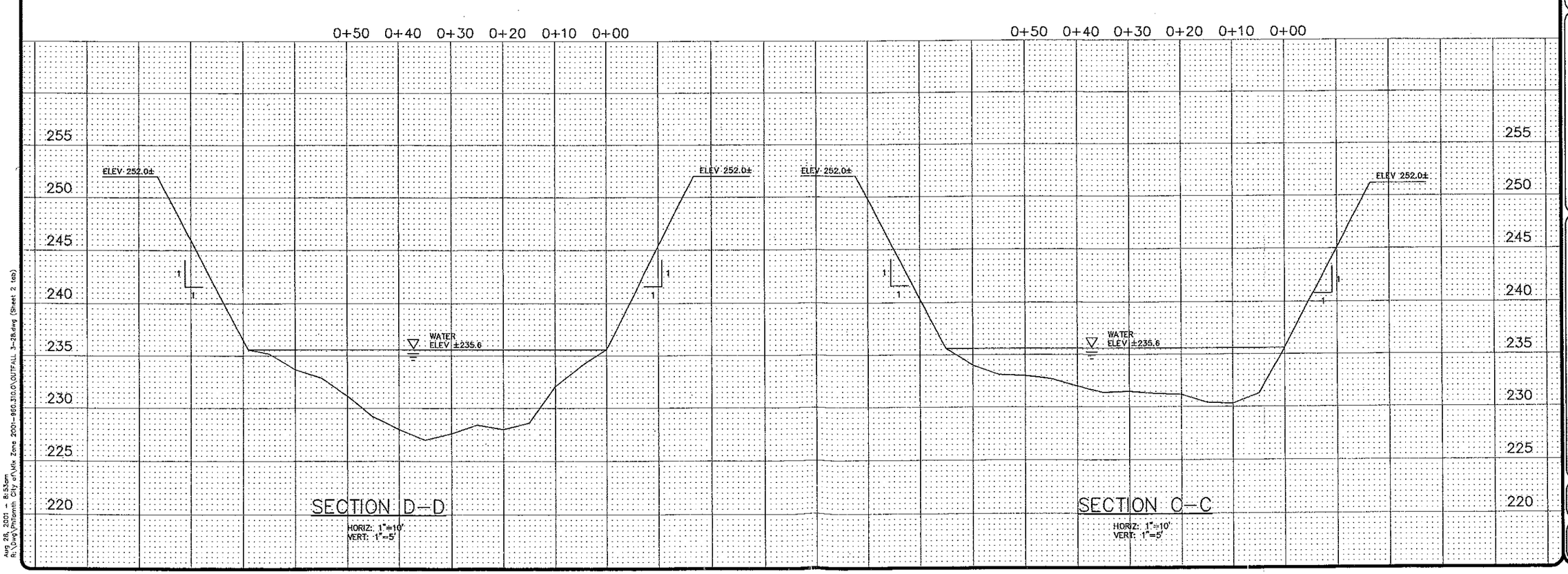

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DSN.
DRN. TMT
CKD. JLT
DATE: AUG 2001

NO.	DATE	DESCRIPTION	BY
		REVISIONS	

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 27, 1971
JOHN L. TIPPENS
#14271
RENEWS: JUNE 30, 2002

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
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CITY OF PHILOMATH
WWTP OUTFALL

MARYS RIVER MIXING ZONE STUDY MARCH 28, 2001 DATA

SHEET
2 OF 2

JOB NUMBER
960.310.0