ORIGINAL

231 W. Michigan Street
Milwaukee, WI 53203
www.we-energies.com

March 22, 2005

Ms. Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426



RE: Way Dam Hydroelectric Project, FERC No. 1759-036
Article 418-Low Dissolved Oxygen Mitigation- Progress Report

Dear Ms. Salas:

Article 418 of the new license issued January 12,2001 for the subject project, required Wisconsin Electric Power Company ( WE ),conducting business as We Energies, to submit, within one year of the effective date of new license issuance, a Plan to address the periodic release of low D.O.-containing water from the Way Dam Project. In correspondence dated December 18, 2002, this plan was filed with the Commission. In an order dated March 18, 2004, the Commission approved this plan

The Plan called for WE to conduct a review of feasible modifications to the Project that could correct the low DO problem as well as their related costs. Alternatives included modifications to the Project that would allow for continued water extraction for the purposes of power generation without impacting the State of Michigan's water quality standard for D.O. in the Project's tailrace.

As a result of this analysis, WE concluded that the only cost effective alternative to correct the low D.O. problem downstream of the Way Dam Project would be to suspend flow through the turbine (cease generation) when D.O. levels in the intake water fall below 3.0 mg/l. This will, for the most part, prevent problems in the river segment downstream of Way Dam. However, approximately 800 ft of the Project's tailrace (which is physically separated from the spillway channel) will continue to experience low D.O. conditions as a result of leakage through the unit and the project's underwater gate. In light of this concern, initial testing with a bubbler system was conducted in 2004 to correct low D.O associated with the leakage flow. More work is planned in 2005.

The alternative analyses that WE performed in 2003 to correct low DO conditions at the Project did not consider turbine venting, because information available at the time indicated the technology would not provide the necessary improvement to meet the state standard for low DO. Additional information has become available that suggests the technique may meet the state standard. We Energies will evaluate this technology when engineering is performed for the Way Dam runner replacement after 2005.

We Energies is hereby filing one original and eight copies of this progress report to the Commission for its approval. Several exhibits constitute this filing; specifically:

| | |
|---|---|
| Exhibit 1 | We Energies' draft progress report as submitted to the agencies for their review |
| Exhibit 2 | We Energies' responses to agency comments |
| Exhibit 3 | We Energies' Final Progress Report |

Also enclosed in this filing is a proof of service on the agencies listed in the copy list. Please call me at (906) 779-2547 if you have questions on this matter.

Sincerely,

William Rauscher

William Rauscher, Manager
Hydroelectric Operations

Encl

cc: Larry Thompson, USFWS
Jessica Mistak, MDNR
John Suppnick, MDEQ

# Certificate of Service

I hereby certify that I have this day served the foregoing document upon all entities specified in the order to issue license to be consulted on matters related to the Commission filing. Service was done pursuant to Rule 2010 of FERC's Rules of Practice and Procedure 18 CFR, Section 385.2010

Dated this day Wednesday, March 23, 2005

Annie Salmona
We Energies

Annie Salmona
We Energies
333 W. Everett Street
Milwaukee, WI 53203
(414) 221-4151

# Exhibit 1

## We Energies' Draft Progress Report as Submitted to The Agencies For Their Review

## Way Dam Hydroelectric Project, FERC No. 1759-036
## Article 418
## Low Dissolved Oxygen Mitigation Plan
## Draft Progress Report (without Vertical Profile Tables).

## Michaud.Dave

**From:** Michaud.Dave
**Sent:** Tuesday, January 11, 2005 2:54 PM
**To:** Jessica Mistak; Suppnick,John (suppnicj@michigan.gov)
**Cc:** Rauscher.Bill
**Subject:** Draft 2004 Progress Report-Way Dam Low DO Mitigation Plan

Greetings and Happy New Year!

Attached to this note are the following:

- A draft progress report for activities that took place in 2004, including our initial work with an aeration system for Way Dam tailrace
- Data files for tailrace monitoring
- Data files for vertical profile measurements taken in Michigamme Reservoir upstream of the dam
- A draft flow chart illustrating operations that will occur in 2005 in response to DO monitoring

We'd appreciate your comments by February 21st so as to allow us time to complete a FERC filing by March 1, 2005.

Please feel free to call me if you have questions concerning these materials.

DRAFT DRAFT DRAFT

Way Dam, FERC Project No.1759-036
Article 418, Dissolved Oxygen Mitigation Plan
2004 Progress Report

January x, 2005

## INTRODUCTION

In a letter dated January 28, 2004, the MDNR requested that We Energies continue to move forward with the mitigation plan that was filed with FERC in December, 2002, which was prepared in response to Article 418 of the new license. The purpose of this plan is to correct the seasonal occurrence of low DO at Way Dam. In its January 28th letter, the MDNR also recommended that the company investigate other low DO correction alternatives including siphoning and bubbling, which according to the MDNR has been successful at other utilities.

In response to this request, the company initiated an evaluation of the bubbling alternative in 2004. The company also conducted continuous temperature and DO monitoring in the Way Dam tailrace during the summer and twice-monthly vertical profile measurements of temperature and DO in the Michigamme Reservoir immediately upstream of the intake structure for the Way Dam generating unit. In addition, temperature and DO were monitored within the plant using continuous monitoring equipment.

## BUBBLING TECHNOLOGY -DESIGN

In early 2004, the company contracted Environmental Dynamics Inc. (EDI) to design a bubbler system for the Way Dam tailrace. EDI is a company that primarily designs oxygenating systems for waste water treatment. Sketches of the power house tailrace and the following operating parameters / requirements were provided to EDI:

- Estimated leakage flow from the generating unit-2 cubic feet per second (CFS)
- Total water volume present in tailrace area: ~1.6 million gallons (this was estimated using the bathymetry drawings for the tailrace area)

- Maintain DO above 3.0 parts per million (ppm) in the tailrace arm of the Michigamme River at all times
- Maximum temperature of the leakage flow: ~ 70 F ( 21.1 C )(actual tailrace range in 2004; 16.2-18.9 C )

EDI designed a system that consisted of six fine bubble aerators that were to be submerged to a depth of 19 ft. EDI's design flow assumption was 1.3 million gallons per day. The actual oxygen required per day was estimated to be 65 pounds. The standard oxygen transfer efficiency was assumed to be 28.5%. Total airflow to the aerators was estimated to be 24 scfm, assuming an air delivery system operating pressure of 9.6 psig at the top of the drop pipe.

Due to fabrication delays (EDI could not promise delivery of the aerator system prior to the anticipated time of low DO occurrence), We Energies purchased the design and the aerator components from EDI. A local company, RC Manufacturing, assembled the system based on the design provided from EDI. We Energies used its existing Gast pumps (bubbler pumps used at the project to prevent icing near the tainter gates in winter) to supply the air for the system. The Gast pumps have a design flow of 21 scfm; therefore two pumps were used to meet the required air flow.

MONITORING PLAN-2004

During the times of the year when low DO is unlikely, the Way Dam in-plant DO instrument is calibrated monthly. Beginning in June, the calibrations were increased to weekly to closely monitor the DO in the bearing cooling water line ( monitoring this water line provides a reasonable measure of DO levels in the lower reaches of the reservoir ). When the DO approached 5.0 PPM, the calibrations were increased to three times weekly. In addition, to assure that the in-plant DO measurements were indicative of what was occurring in the tailrace, Winkler analyses of grab samples taken in the tailrace were obtained beginning in mid-June. The grab samples were obtained from three areas: off the corner of the power house to the right of the draft tube in about 15' of water; in the tailrace area to the right of the under water gate in about 5' of water ; and at a point about 75' downstream in the tailrace near the first of two continuous recording sondes.

Continuous recording sondes were deployed in two locations: the first location was as described above; the second was located approximately 500 ft downstream of the first sonde. The sondes were deployed June 16 and were changed out every two weeks until they were retrieved September 19.

Vertical profile measurements in the reservoir were taken twice per month during the period monitored with continuous recording sondes.

BUBBLING TECHNOLOGY-OBSERVATIONS

**Monitoring-Overview**

In 2004, the following operation plan for the generator had been established:

- when DO dropped below 5.0 ppm, as measured by the in-plant DO instrument, the total flow released by the project was to be split ~50/50 between the spillway and generation flows
- when DO dropped below 3.0 ppm, as measured by the in-plant DO instrument, flow through the generator was to be discontinued ; all flow released by the project was to be via spillage; the aeration system was to be activated.

Due to cooler than normal temperatures and above average rainfall earlier in the summer, low DO conditions did not materialize until 7/22/04. This is the first date DO dropped below 5.0 ppm. At this time, the flow through the project was split between the generator and the spillway.

On 7/28/04, the DO dropped below 3.0 ppm and the generator was taken off line and all of the flow, except for leakage flow through the wicket gates, was passed through the spillway. At this time, the aeration system was activated.

On 8/10/04 the head water gate for the generator was closed in an attempt to cut down on the leakage flow through the unit's wicket gates (note: when the head gate for the generator is closed, the in-plant DO instrument no longer accurately measures the DO of the leakage flow).

On 8/26/04, in response to tailrace DO measurements (results of grab samples) the unit was put back on line.

**Monitoring-Detailed Observations**

When the flow through the generator was above 450 cfs, the DO as measured by the in-plant instrument and by the sonde downstream were comparable. We noted that the Winkler titration measurements verified the downstream sonde readings. This was a very helpful observation in that it showed that grab samples taken from the tailrace could be used to determine the DO in the tailrace without the services of the in-plant instrument.

When the flow through the generator was split with the spillway (July 22$^{nd}$) there was an increase in aeration visually noted in the unit's remaining discharge. The DO data collected by the downstream sonde for the subsequent next few days appears to support this observation. (Note: since the in-plant DO instrument is situated upstream of the unit's discharge, this instrument cannot detect any potential increases in DO added by the turbine runner operating at 300 cfs).

The unit was taken off line on July 28$^{th}$. In response to this action, the DO dropped from 4.5 to 2.5 PPM, as measured by the downstream sonde, in approximately 12 hours. This may have been due to the discontinuation of aeration provided by the generator under low flows. At this time, the aeration system was activated.

From the time when the unit was taken off (July 28th) to when the head gate was closed (August 10th), the aeration system improved the DO in the tailrace, but did not increase the DO levels above 3.0 ppm. At this time, the company concluded that the actual leakage flow through the generator with the head gate open was likely greater than the 2 CFS assumed previously.

When the headgate was closed on August 10th, the DO as measured by the downstream sonde began a general increasing trend (ignoring for the moment the two pump failures experienced after 8/10). For example,on 8/11/04, the DO in the tailrace, as measured by the downstream sonde had increased above 3.0 ppm and did not go below this value for the rest of the summer. On 8/14/04, the DO in the tailrace, as measured by the downstream sonde had increased above 4.0 ppm and did not go below this value for the rest of the summer. On 8/17/04, the DO in the tailrace, as measured by the downstream sonde had increased above 5.0 ppm and did not go below this value for the rest of the summer.

By contrast, the vertical profile data during this time frame indicated that DO levels in the lowest reaches of the reservoir (upstream of the unit's intake opening) were still well below 5.0 ppm.

Results of the entire continuous monitoring period as well as a more detailed examination of the period 22 July through 26 August are provided as Figures 1 and 2, respectively, to this report. The summary results for temperature and DO, based on the continuous monitoring program are provided in Table 1, while the results of the vertical profile measurements are provided in Appendix A.

## BUBBLING TECHNOLOGY-CONCLUSIONS, PROPOSED REVISIONS FOR 2005

The Gast pumps used to supply the air for the aeration system, experienced many failures (at least five during the testing performed in summer, 2004). The DO as measured by the downstream sonde showed declines in DO immediately following pump failure.

These failures was most likely due to the fact that these pumps have only been operated during the winter months when the ambient temperature is a lot less than during the summer months. A different air pump (Roots pump, specifications 30 ACFM @ 10 PSI) has been purchased for use in 2005.

During an internal review of the 2004 monitoring / bubbling experimental data, company staff noticed that on two occasions during the low DO period, the DO increased (as measured by the downstream sonde) when the under water gate was opened to provide required minimum flow through the project . The first occurrence was on 8/17 when the Hemlock generating unit tripped offline due to a thunderstorm. Flow was increased from Way Dam to boost river flow. The duration of this event was only a couple of hours. The second occurrence was on 8/26/04 when the unit was being brought on line. Note, that on 8/17/04, the under water gate had initially been closed; therefore, the in-plant DO monitor was not providing accurate DO data.

Apparently, when the entire minimum flow is being passed through the under water gate, the higher flow induces withdrawals from the more oxygenated upper layers of the reservoir. This does not occur when the unit is offline and only passing leakage flow. In support of this explanation, operators have noted that when large amounts of water are passed through the underwater gate, it creates a vortex in the intake area. It has also been noted by hydro personnel that we are probably getting additional aeration from the turbulence of the water at the energy dissipater wall below the underwater gate during spills through this gate.

**Conclusions:**

When the unit was taken off line on 7/28/04, and the aeration system operation was initiated, the leakage flow through the unit with the head gate open probably exceeded the design limit of the aeration system. Even if one were to exclude the pump failures that occurred prior to 8/10/04, the system did not appear capable of maintaining DO above 3.0 ppm. When the head gate was closed on 8/10/04, DO levels above 3.0 ppm were attained for the rest of the summer, even though the vertical profile measurements indicated the presence of low DO upstream of the intake during this same period.

**Recommendations:**

In 2005, we will continue to monitor the DO closely during the onset to the critical low DO period (late June to early July). This will be accomplished by utilizing the in-plant DO instrument. We will similarly increase in-plant instrument calibrations cycles to one per week starting in June. Continuous monitoring utilizing the sondes will likewise be performed in the tailrace from mid-June through mid-September.

When the DO approaches 5.0 ppm as measured by the in-plant DO instrument, operations will split the flow between the generator and the under water gate. This will be done to determine if the turbulence created by the under water gate discharge adds DO to the water. The percentage of flow between the under water gate and generator can be varied to maximize the DO level in the river. To monitor the effect that the under water gate has on the DO, two readings will be obtained by the operator using titration. The titration readings will be obtained three times weekly. The first will be between the corner of the powerhouse and the under water gate. The second will be ~70' downstream of the powerhouse. A comparison will be made between the readings to determine if the under water gate is adding sufficient DO to keep the tailrace above 5.0 ppm.. If this is successful, we will continue in this mode of operation.

If the DO drops below 5.0 ppm, as determined by titration readings taken at the second location described above, the flow will be split between the generator and the spillway. At this time, the operation will be similar to past years, whereby the total flow released by the project is mixed using generation and spilling through the tainter gates. Since the in-plant DO monitor cannot assess the potential increase of DO added by reduced operation of the unit, by monitoring the DO in the tailrace at the location discussed above, we will determine if the DO in the river can be maintained above 3.0 ppm without bubbling. If the DO remains above 3.0 ppm, we propose to continue this mode of operation.

If the DO drops below 3.0 ppm, as determined by titration readings taken at the second location as described above, flow through the generator will be discontinued. At this time the flow will be split between the under water gate and the spillway. The goal here is to see if the under water gate can increase the DO and keep it above 3.0 ppm. If the DO remains above 3.0 ppm, we propose to continue this mode of operation.

If the DO drops below 3.0 ppm, as determined by the readings obtained by titration, the underwater gate will be closed and all project flow will be passed via the spillway. At this time, the tailrace aeration system will be turned on. The head gate to the unit will also be closed at this time to minimize the leakage flow. We will continue to monitor the DO at the two locations described above by titration.

This plan will maintain DO in the main portion of the river between Way Dam and Hemlock Dam above 5.0 ppm, and will maintain the DO above 3.0 ppm in the Way Dam tailrace down to its confluence with the spillway tailrace.

An operation flow sheet summarizing these actions is also attached to this report

**Figure 1 Way Dam 2004 Tailrace Data**
Flow vs Dissolved oxygen June 16 Sept 23 2004

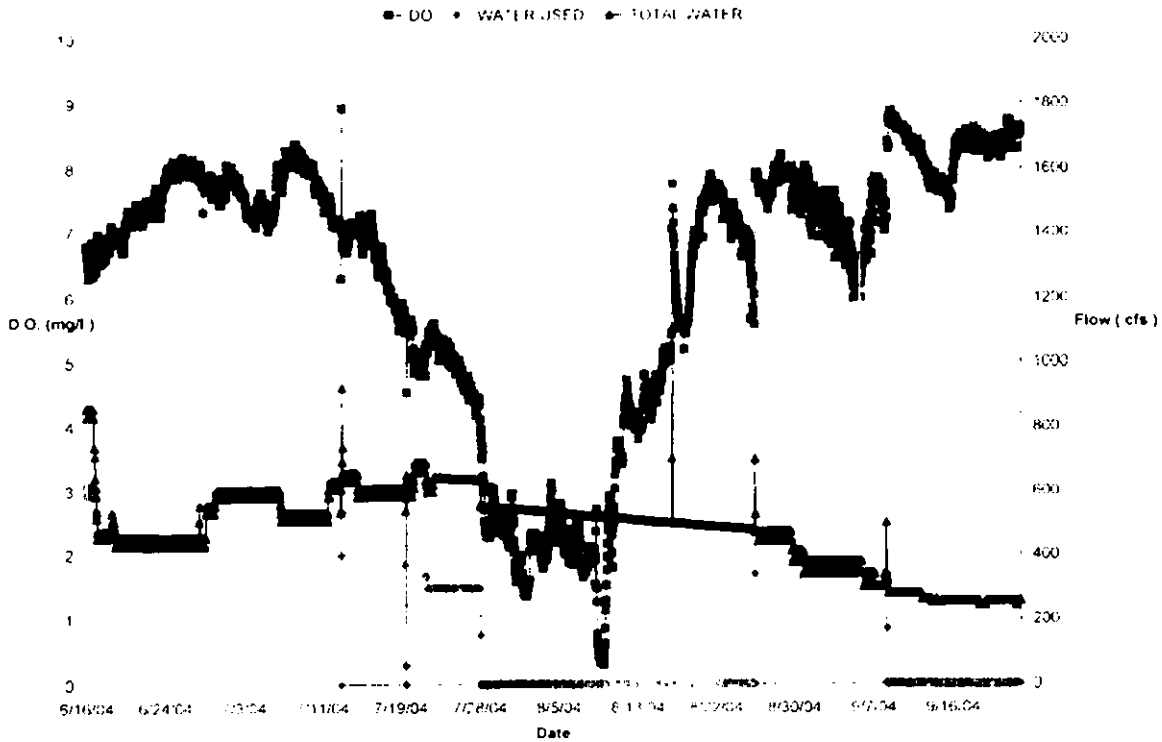


Table 1 Summary of temperature and dissolved oxygen data collected by continuous monitoring sondes in Way Dam tailrace, June-September, 2004

Dissolved Oxygen Limit 5.0 mg/l

Monthly Average Temperature Limits

| | Degree F | Degree C |
|---|---|---|
| June | 80 | 26.7 |
| July | 83 | 28.3 |
| August | 81 | 27.2 |
| Sept | 74 | 23.3 |

**Way Dam Tailrace ( TR1 ) - 2004 Data Summary**

| Month | OBS | Temperature ( Degrees C ) | | | DO % Saturation | | | Dissolved Oxygen ( mg/l ) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Max | Min | Mean | Max | Min | Mean | Max | Min |
| June | 345 | 17.1 | 18.1 | 17.1 | 78.2 | 86.6 | 78.2 | 7.4 | 8.2 | 7.4 |
| July | 744 | 17.3 | 18.6 | 16.2 | 65.5 | 93.0 | 21.2 | 5.2 | 8.9 | 2.0 |
| Aug | 744 | 17.4 | 18.9 | 16.3 | 52.1 | 89.6 | 2.9 | 4.9 | 8.2 | 0.3 |
| Sep | 539 | 17.9 | 18.5 | 17.4 | 83.8 | 94.8 | 64.0 | 7.8 | 8.9 | 6.0 |

06/17/04 2100 Deleted one hour due to error in data

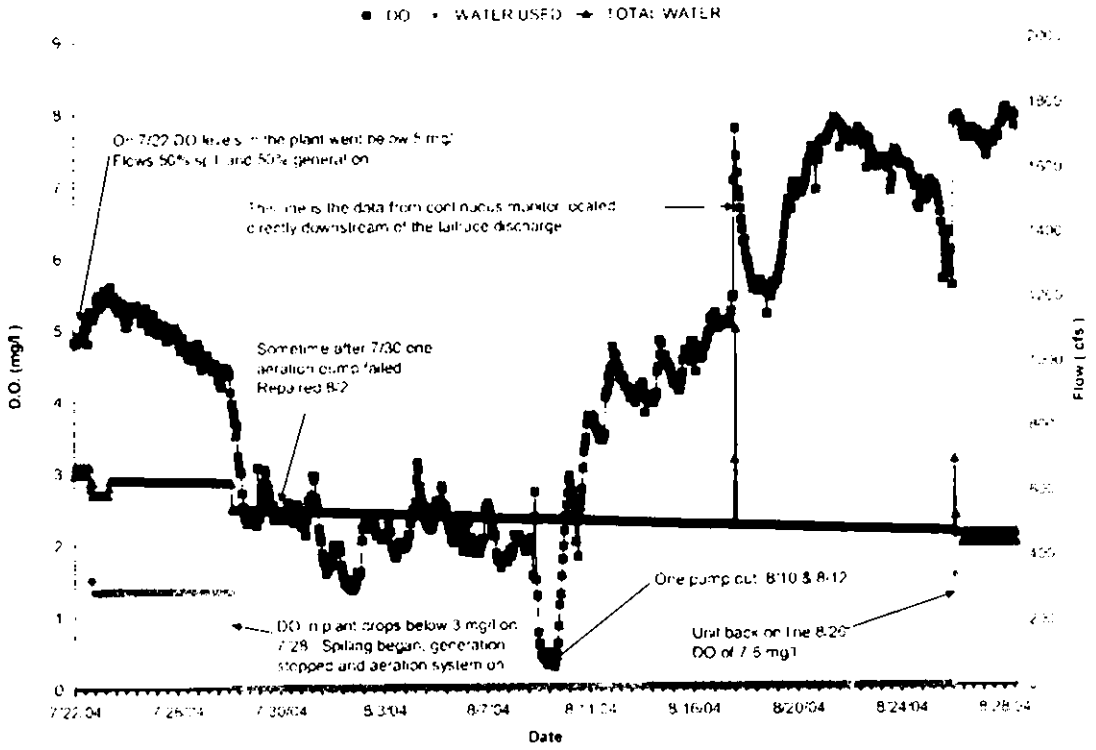
99.9% Data Recovery

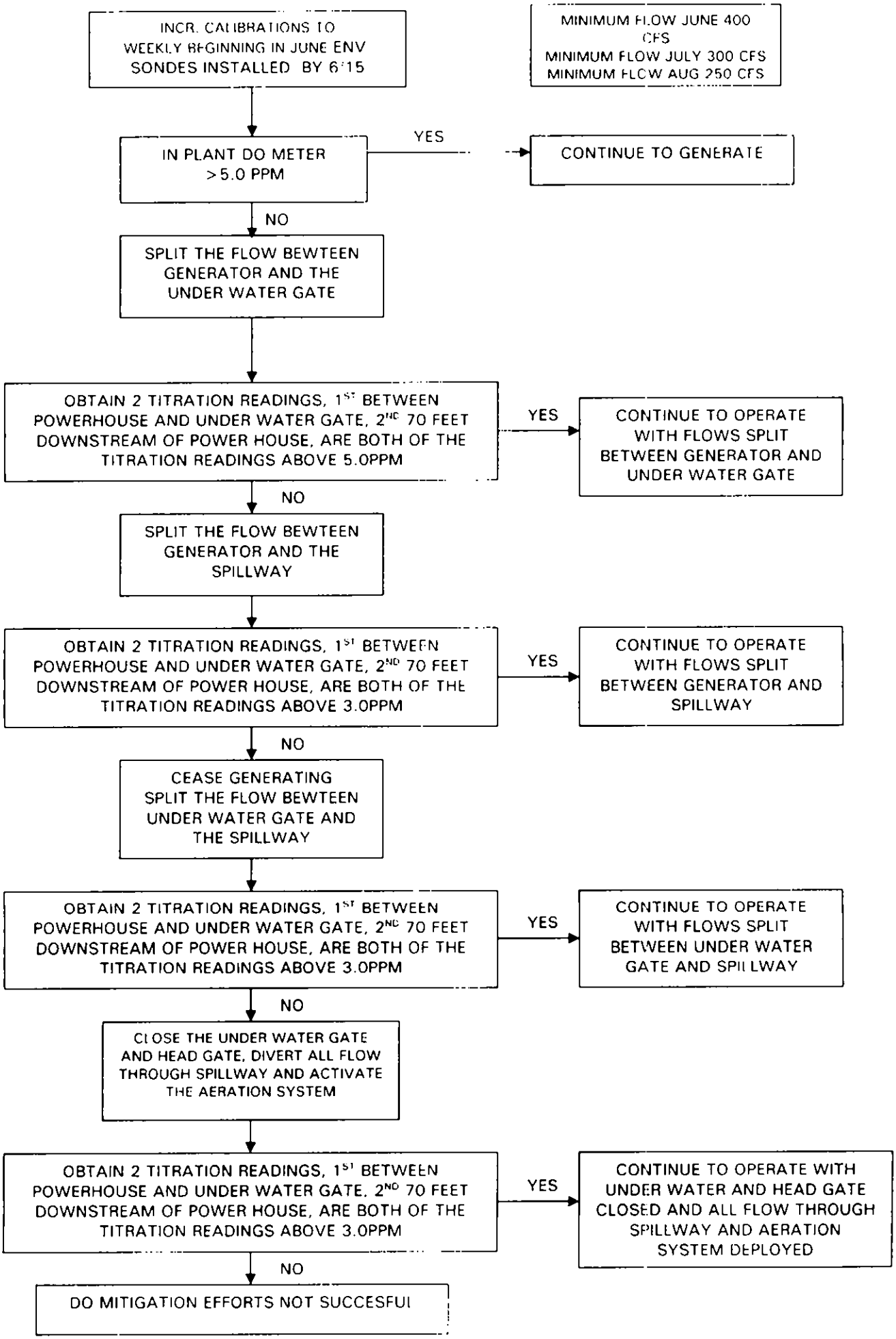
**Way Dam Tailrace Downstream ( TR3 ) - 2004 Data Summary**

| Month | OBS | Temperature ( Degrees C ) | | | DO % Saturation | | | Dissolved Oxygen ( mg/l ) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Max | Min | Mean | Max | Min | Mean | Max | Min |
| June | 345 | 16.9 | 17.9 | 15.4 | 82.8 | 90.9 | 67.2 | 7.9 | 8.6 | 6.6 |
| July | 744 | 17.4 | 18.7 | 15.9 | 65.8 | 90.9 | 14.6 | 6.2 | 8.7 | 1.4 |
| Aug | 744 | 17.3 | 18.9 | 15.8 | 55.1 | 97.5 | 4.4 | 5.2 | 9.0 | 0.4 |
| Sep | 539 | 18.1 | 18.7 | 17.6 | 81.4 | 92.9 | 65.8 | 7.6 | 8.6 | 6.1 |

100% Data Recovery

**Figure 2 Way Dam 2004 Tailrace Data**
**Flow vs. Dissolved Oxygen 7/22 - 8/28, 2004**





# Exhibit 2

## We Energies Response to Recommendations Received From Consulted Agencies

## Way Dam Hydroelectric Project, FERC No. 1759-036
## Article 418
## Low Dissolved Oxygen Mitigation Plan
## Draft Progress Report

Response and Reply to Email note sent by
Jessica Mistak, MDNR, February 23, 2005

Response and Reply to Email note sent by
John Suppnick, MDEQ, March 10, 2005

**Michaud.Dave**

**From:** Michaud.Dave
**Sent:** Wednesday, February 23, 2005 10:38 AM
**To:** 'Jessica Mistak'
**Cc:** Suppnick,John (suppnicj@michigan.gov); Cevigney.Scott; Rauscher.Bill
**Subject:** RE: FW: Draft 2004 Progress Report-Way Dam Low DO MitigationPlan

Thank you for pointing out an error in our draft report. It should have read...."continuous monitoring will be conducted from mid-June through mid- September". A progress report will be filed in early 2006, as well.

**From:** Jessica Mistak [mailto:mistakjl@michigan.gov]
**Sent:** Wednesday, February 23, 2005 9:28 AM
**To:** Michaud.Dave
**Cc:** John Suppnick
**Subject:** Re: FW: Draft 2004 Progress Report-Way Dam Low DO MitigationPlan

Dave,
I apologize for the late comments- I meant to complete my review last week and, instead, came down with the flu.

My only concern is that you propose 2005 DO monitoring only in late June to early July, or what you call the critical low DO period. Although I understand 2004 was a cooler than normal year, DO problems were experienced July through August and I don't believe this is atypical. My recommendation is that you monitor DO from June 20 through August 31, 2005. In addition, please file a 2005 progress report (similar to the 2004 progress report) in early 2006.

Thank you,
Jessica

<>< <>< <>< <>< <>< <>< <>< <><
Jessica Mistak, Senior Fisheries Biologist
MDNR Marquette Fisheries Station
484 Cherry Creek Rd
Marquette, MI 49855
906-249-1611 ext. 308
FAX 906-249-3190
><> ><> ><> ><> ><> ><> ><> ><>

>>> "Michaud.Dave" <Dave.Michaud@we-energies.com> 02/22/05 9:24 AM >>>

**From:** Michaud.Dave
**Sent:** Tuesday, February 22, 2005 8:22 AM

**To:** 'Jessica Mistak'; 'Suppnick,John (suppnicj@michigan.gov)'

**Cc:** Rauscher Bill; Michaud.Dave

**Subject:** RE: Draft 2004 Progress Report-Way Dam Low DO Mitigation Plan

Jessica and John:

How is your review coming along? When do you anticipate providing comments?

---

**From:** Michaud.Dave

**Sent:** Tuesday, January 11, 2005 2:54 PM

**To:** Jessica Mistak; Suppnick,John (suppnicj@michigan.gov)

**Cc:** Rauscher Bill

**Subject:** Draft 2004 Progress Report-Way Dam Low DO Mitigation Plan

Greetings and Happy New Year!

Attached to this note are the following:

- A draft progress report for activities that took place in 2004, including our initial work with an aeration system for Way Dam tailrace
- Data files for tailrace monitoring
- Data files for vertical profile measurements taken in Michigamme Reservoir upstream of the dam
- A draft flow chart illustrating operations that will occur in 2005 in response to DO monitoring

We'd appreciate your comments by February 21st so as to allow us time to complete a FERC filing by March 1, 2005.

Please feel free to call me if you have questions concerning these materials.

## Michaud.Dave

**From:** John Suppnick [SUPPNICJ@michigan.gov]
**Sent:** Thursday, March 10, 2005 6:47 AM
**To:** Michaud.Dave
**Cc:** Jessica Mistak
**Subject:** Re: FW: Draft 2004 Progress Report-Way Dam Low DO Mitigation Plan

Dave,

Thank you for sending us a copy of the draft 2004 progress report on your efforts to find a solution to the low dissolved oxygen (DO) problem at the Way dam. We have the following comments.

We expect that you should be able to make a determination of what long term solution will work at the Way dam following the 2005 monitoring season, a period of data analysis and consultation with us. Therefore your feasibility study should be completed by February 1 of 2006.

You appear to be proceeding under the assumption that 3 mg/l will be the eventual goal for DO in the tailrace. Although we have not ruled out approving the tailrace as a mixing zone where a 3 mg/l DO level would be acceptable we have not received from you the biological data necessary to make such a determination. My December 11, 2002 letter to you stated that for any mitigation options that result in DO levels less than 5 mg/l at ary location in the stream, your evaluation should discuss the area affected, the type of habitat present in the affected area, and the expected effect on the aquatic life that are likely to inhabit this area. This process is spelled out in rule 1082 of Michigan's Water Quality Standards (attached).

Your plan for operations and data collection at Way dam this summer indicate that the bubblers would not be turned on until the DO is less than 3 mg/l. However, until the mixing zone demonstration is made, your operations scheme should attempt to maintain 5 mg/l in the tailrace channel. Your DO testing should be designed so that you can calculate the DO deficit ratio (deficit before aeration/deficit after aeration) attributed to the bubblers. This will allow you to determine how the bubblers would perform under ary DO conditions.

If you have any questions about these comments please give me a call.

John

John Suppnick
Michigan Department of Environmental Quality Water Bureau
517-335-4192
suppnicj@michigan.gov

>>> "Michaud.Dave" <Dave.Michaud@we-energies.com> 03/09/05 9:21 AM >>>
John, were you still planning to provide comments?

> -----Original Message-----
> From: Michaud.Dave
> Sent: Tuesday, February 22, 2005 8:22 AM
> To: 'Jessica Mistak'; 'Suppnick,John (suppnicj@michigan.gov)'
> Cc: Rauscher.Bill; Michaud.Dave
> Subject: RE: Draft 2004 Progress Report-Way Dam Low DO Mitigation
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> Jessica and John:
>
> How is your review coming along? When do you anticipate providing
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> From: Michaud.Dave
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> To: Jessica Mistak; Suppnick,John (suppnicj@michigan.gov)
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> We'd appreciate your comments by February 21st so as to allow us time
> to complete a FERC filing by March 1, 2005.
>
> Please feel free to call me if you have questions concerning these
> materials.

Reply to John Suppnick ( MDEQ ), March 10, 2005 email response to the Company's Draft Report:

The Company agrees that the monitoring and mitigation activities planned for summer, 2005 should provide sufficient information for the Company's development of a long-term solution for summer low-DO problems. This assumes that normal temperature and rainfall conditions will prevail this summer.

We agree that our mitigation efforts should be geared toward maintaining the 5.0 mg/l standard and not the 3.0 mg/l goal that was stated in the draft Progress Report. As a result, we have revised the Recommendations section of the Progress Report. All proposed actions are now aimed at maintaining the 5.0 mg/l standard in the Project's tailrace. If we simply cannot achieve the 5.0 mg/l standard, but can at least meet the 3.0 mg/l goal, we will initiate consultation with the MDEQ as to the nature of biological studies that may be necessary to obtain a mixing zone variance for the tailrace section of the river.

# Exhibit 3

## We Energies' Final Progress Report

## Way Dam Hydroelectric Project, FERC No. 1759-036
## Article 418
## Low Dissolved Oxygen Mitigation Plan

Way Dam, FERC Project No.1759-036
Article 418, Dissolved Oxygen Mitigation Plan
2004 Progress Report

March 22, 2005

## INTRODUCTION

In a letter dated January 28, 2004, the MDNR requested that We Energies continue to move forward with the mitigation plan that was filed with FERC in December, 2002, which was prepared in response to Article 418 of the new license. The purpose of this plan is to correct the seasonal occurrence of low DO at Way Dam. In its January 28th letter, the MDNR also recommended that the company investigate other low DO correction alternatives including siphoning and bubbling, which according to the MDNR has been successful at other utilities.

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## BUBBLING TECHNOLOGY DESIGN

In early 2004, the company contracted Environmental Dynamics Inc. (EDI) to design a bubbler system for the Way Dam tailrace. EDI is a company that primarily designs oxygenating systems for waste water treatment. Sketches of the power house tailrace and the following operating parameters / requirements were provided to EDI:

- Estimated leakage flow from the generating unit-2 cubic feet per second (CFS)
- Total water volume present in tailrace area: ~1.6 million gallons (this was estimated using the bathymetry drawings for the tailrace area)

- Maintain DO above 3.0 parts per million (ppm) in the tailrace arm of the Michigamme River at all times
- Maximum temperature of the leakage flow: ~ 70 F ( 21.1 C )(actual tailrace range in 2004; 16.2-18.9 C )

EDI designed a system that consisted of six fine bubble aerators that were to be submerged to a depth of 19 ft. EDI's design flow assumption was 1.3 million gallons per day, the approximate static volume of the entire tailrace segment. The actual oxygen required per day was estimated to be 65 pounds. The standard oxygen transfer efficiency was assumed to be 28.5%. Total airflow to the aerators was estimated to be 24 scfm, assuming an air delivery system operating pressure of 9.6 psig at the top of the drop pipe.

Due to fabrication delays (EDI could not promise delivery of the aerator system prior to the anticipated time of low DO occurrence), We Energies purchased the design and the aerator components from EDI. A local company, RC Manufacturing, assembled the system based on the design provided from EDI. We Energies used its existing Gast pumps (bubbler pumps used at the project to prevent icing near the tainter gates in winter) to supply the air for the system. The Gast pumps have a design flow of 21 scfm; therefore two pumps were used to meet the required air flow.

## MONITORING PLAN-2004

During the times of the year when low DO is unlikely, the Way Dam in-plant DO instrument is calibrated monthly. Beginning in June, the calibrations were increased to weekly to closely monitor the DO in the bearing cooling water line ( monitoring this water line provides a reasonable measure of DO levels in the lower reaches of the reservoir ). When the DO approached 5.0 PPM, the calibrations were increased to three times weekly. In addition, to assure that the in-plant DO measurements were indicative of what was occurring in the tailrace, Winkler analyses of grab samples taken in the tailrace were obtained beginning in mid-June. The grab samples were obtained from three areas: off the corner of the power house to the right of the draft tube in about 15' of water; in the tailrace area to the right of the under water gate in about 5' of water ; and at a point about 75' downstream in the tailrace near the first of two continuous recording sondes.

Continuous recording sondes were deployed in two locations: the first location was as described above; the second was located approximately 500 ft downstream of the first sonde. The sondes were deployed June 16 and were changed out every two weeks until they were retrieved September 19.

Vertical profile measurements in the reservoir were taken twice per month during the period monitored with continuous recording sondes. The results of these measurements are attached to this report.

## BUBBLING TECHNOLOGY-OBSERVATIONS

### Monitoring-Overview

In 2004, the following operation plan for the generator had been established:

- when DO dropped below 5.0 ppm, as measured by the in-plant DO instrument, the total flow released by the project was to be split ~50/50 between the spillway and generation flows
- when DO dropped below 3.0 ppm, as measured by the in-plant DO instrument, flow through the generator was to be discontinued ; all flow released by the project was to be via spillage; the aeration system was to be activated.

Due to cooler than normal temperatures and above average rainfall earlier in the summer, low DO conditions did not materialize until 7/22/04. This is the first date DO dropped below 5.0 ppm. At this time, the flow through the project was split between the generator and the spillway.

On 7/28/04, the DO dropped below 3.0 ppm and the generator was taken off line and all of the flow, except for leakage flow through the wicket gates, was passed through the spillway. At this time, the aeration system was activated.

On 8/10/04 the head water gate for the generator was closed in an attempt to cut down on the leakage flow through the unit's wicket gates (note: when the head gate for the generator is closed, the in-plant DO instrument no longer accurately measures the DO of the leakage flow).

On 8/26/04, in response to tailrace DO measurements (results of grab samples) the unit was put back on line.

**Monitoring-Detailed Observations**

When the flow through the generator was above 450 cfs, the DO as measured by the in-plant instrument and by the sonde downstream were comparable. We noted that the Winkler titration measurements verified the downstream sonde readings. This was a very helpful observation in that it showed that grab samples taken from the tailrace could be used to determine the DO in the tailrace without the services of the in-plant instrument.

When the flow through the generator was split with the spillway (July 22$^{nd}$) there was an increase in aeration visually noted in the unit's remaining discharge. The DO data collected by the downstream sonde for the subsequent next few days appears to support this observation. (Note: since the in-plant DO instrument is situated upstream of the unit's discharge, this instrument cannot detect any potential increases in DO added by the turbine runner operating at 300 cfs).

The unit was taken off line on July 28$^{th}$. In response to this action, the DO dropped from 4.5 to 2.5 PPM, as measured by the downstream sonde, in approximately 12 hours. This may have been due to the discontinuation of aeration provided by the generator under low flows. At this time, the aeration system was activated.

From the time when the unit was taken off (July 28th) to when the head gate was closed (August 10th), the aeration system improved the DO in the tailrace, but did not increase the DO levels above 3.0 ppm. At this time, the company concluded that the actual leakage flow through the generator with the head gate open was likely greater than the 2 CFS assumed previously.

When the headgate was closed on August 10th, the DO as measured by the downstream sonde began a general increasing trend (ignoring for the moment the two pump failures experienced after 8/10). For example, on 8/11/04, the DO in the tailrace, as measured by the downstream sonde had increased above 3.0 ppm and did not go below this value for the rest of the summer. On 8/14/04, the DO in the tailrace, as measured by the downstream sonde had increased above 4.0 ppm and did not go below this value for the rest of the summer. On 8/17/04, the DO in the tailrace, as measured by the downstream sonde had increased above 5.0 ppm and did not go below this value for the rest of the summer.

By contrast, the vertical profile data during this time frame indicated that DO levels in the lowest reaches of the reservoir (upstream of the unit's intake opening) were still well below 5.0 ppm.

Results of the entire continuous monitoring period as well as a more detailed examination of the period 22 July through 26 August are provided as Figures 1 and 2, respectively, to this report. The summary results for temperature and DO, based on the continuous monitoring program are provided in Table 1, while the results of the vertical profile measurements are provided in Appendix A.

## BUBBLING TECHNOLOGY-CONCLUSIONS, PROPOSED REVISIONS FOR 2005

The Gast pumps used to supply the air for the aeration system, experienced many failures (at least five during the testing performed in summer, 2004). The DO as measured by the downstream sonde showed declines in DO immediately following pump failure.

These failures were most likely due to the fact that these pumps have only been operated during the winter months when the ambient temperature is a lot less than during the summer months. A different air pump (Roots pump,) has been purchased for use in 2005.

During an internal review of the 2004 monitoring / bubbling experimental data, company staff noticed that on two occasions during the low DO period, the DO increased (as measured by the downstream sonde) when the under water gate was opened to provide required minimum flow through the project . The first occurrence was on 8/17 when the Hemlock generating unit tripped offline due to a thunderstorm. Flow was increased from Way Dam to boost river flow. The duration of this event was only a couple of hours. The second occurrence was on 8/26/04 when the unit was being brought on line. Note, that on 8/17/04, the under water gate had initially been closed; therefore, the in-plant DO monitor was not providing accurate DO data.

Apparently, when the entire minimum flow is being passed through the under water gate, the higher flow induces withdrawals from the more oxygenated upper layers of the reservoir. This does not occur when the unit is offline and only passing leakage flow. In support of this explanation, operators have noted that when large amounts of water are passed through the underwater gate, it creates a vortex in the intake area. It has also been noted by hydro personnel that we are probably getting additional aeration from the turbulence of the water at the energy dissipater wall below the underwater gate during spills through this gate.

**Conclusions:**

When the unit was taken off line on 7/28/04, and the aeration system operation was initiated, the leakage flow through the unit with the head gate open probably exceeded the design limit of the aeration system. Even if one were to exclude the pump failures that occurred prior to 8/10/04, the system did not appear capable of maintaining DO above 3.0 ppm. When the head gate was closed on 8/10/04, DO levels above 3.0 ppm were attained for the rest of the summer, even though the vertical profile measurements indicated the presence of low DO upstream of the intake during this same period.

**Recommendations:**

In 2005, we will continue to monitor the DO closely during the onset to the critical low DO period (late June to early July). This will be accomplished by utilizing the in-plant DO instrument. We will similarly increase in-plant instrument calibrations cycles to one per week starting in June. Continuous monitoring utilizing the sondes will likewise be performed in the tailrace from mid-June through mid-September.

When the DO approaches 5.0 ppm as measured by the in-plant DO instrument, operations will split the flow between the generator and the under water gate. This will be done to determine if the turbulence created by the under water gate discharge adds DO to the water. The percentage of flow between the under water gate and generator can be varied to maximize the DO level in the river. To monitor the effect that the under water gate has on the DO, two readings will be obtained by the operator using titration. The titration readings will be obtained three times weekly. The first will be between the corner of the powerhouse and the under water gate. The second will be ~70' downstream of the powerhouse. A comparison will be made between the readings to determine if the under water gate is adding sufficient DO to keep the tailrace above 5.0 ppm.. If this is successful, we will continue in this mode of operation.
If the DO drops below 5.0 ppm, as determined by the readings obtained by titration, the generator will be taken off line and virtually all of the required minimum flow from the project will be passed through the underwater gate. A small amount of flow will be passed downstream via the spillway.

If the DO in the tailrace cannot be maintained at or above 5.0 ppm by the flow being passed through the underwater gate, the underwater gate will be closed. At this time, the tailrace aeration system will be turned on to counteract the low DO present in the leakage flow. We will continue to monitor the DO at the two locations described above by titration.

If the DO in the tailrace can not be maintained above 5.0 ppm with the aeration system deployed, but can maintain it above 3.0 ppm, the Company may petition the MDEQ to allow the entire tailrace length to become a mixing zone, wherein DO transitions to the standard of 5.0 ppm prior to joining the main river. To accomplish this, the Company will need to conduct environmental studies per Michigan water quality law (323.1082). The Company will consult with the MDEQ as to the exact site-specific requirements for this petition.

**Figure 1 Way Dam 2004 Tailrace Data**
Flow vs. Dissolved oxygen June 16 -Sept 23, 2004

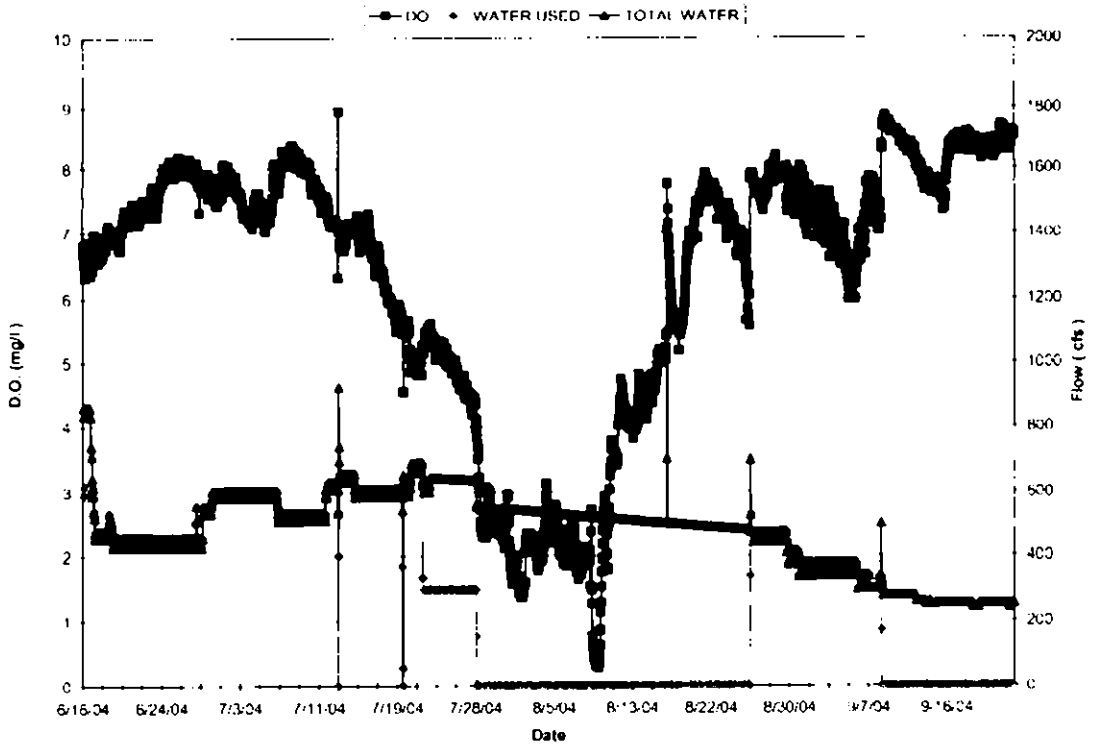


Table 1 Summary of temperature and dissolved oxygen data collected by continuous monitoring sondes in Way Dam tailrace, June-September, 2004

| | | Degree F | Degree C |
|---|---|---|---|
| Dissolved Oxygen Limit 5.0 mg/l | | | |
| Monthly Average Temperature Limits: | June | 80 | 26.7 |
| | July | 83 | 28.3 |
| | August | 81 | 27.2 |
| | Sept | 74 | 23.3 |

**Way Dam Tailrace ( TR1 ) - 2004 Data Summary**

| Month | OBS | Temperature ( Degrees C ) | | | DO % Saturation | | | Dissolved Oxygen ( mg/l ) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Max | Min | Mean | Max | Min | Mean | Max | Min |
| June | 345 | 17.1 | 18.1 | 17.1 | 78.2 | 86.6 | 78.2 | 7.4 | 8.2 | 7.4 |
| July | 744 | 17.3 | 18.6 | 16.2 | 65.5 | 93.0 | 21.2 | 6.2 | 8.9 | 2.0 |
| Aug | 744 | 17.4 | 18.9 | 16.3 | 52.1 | 89.6 | 2.9 | 4.9 | 8.2 | 0.3 |
| Sep | 539 | 17.9 | 18.5 | 17.4 | 83.8 | 94.8 | 64.0 | 7.8 | 8.9 | 6.0 |

06/17/04 2100 Deleted one hour due to error in data.

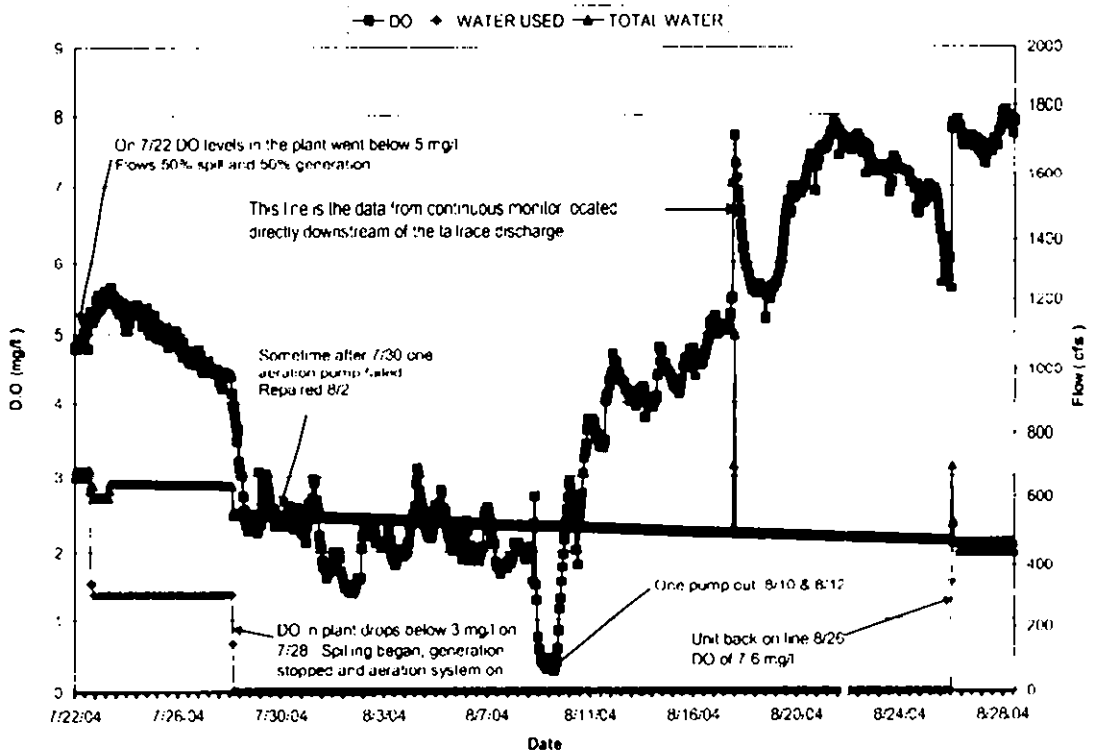
99.9% Data Recovery

**Way Dam Tailrace Downstream ( TR3 ) - 2004 Data Summary**

| Month | OBS | Temperature ( Degrees C ) | | | DO % Saturation | | | Dissolved Oxygen ( mg/l ) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Max | Min | Mean | Max | Min | Mean | Max | Min |
| June | 345 | 16.9 | 17.9 | 15.4 | 82.8 | 90.9 | 67.2 | 7.9 | 8.6 | 6.6 |
| July | 744 | 17.4 | 18.7 | 15.9 | 65.8 | 90.9 | 14.6 | 6.2 | 8.7 | 1.4 |
| Aug | 744 | 17.3 | 18.9 | 15.8 | 55.1 | 97.5 | 4.4 | 5.2 | 9.0 | 0.4 |
| Sep | 539 | 18.1 | 18.7 | 17.6 | 81.4 | 92.9 | 65.8 | 7.6 | 8.6 | 6.1 |

100% Data Recovery

**Figure 2 Way Dam 2004 Tailrace Data**
**Flow vs. Dissolved Oxygen 7/22 - 8/28, 2004**



**17-Jun-04**

*Approximate air temp 15 5 C*
*Secci Depth 6 0 Water depth ~40* *Time 0845*
*Winds NE 8-12 mph* *cool and breezy*
*Taken in flowage*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0 0 | 19 6 | 8.7 | 96.4 | 80 | 7 1 |
| 0.5 | 19 6 | 8.7 | 96 1 | 80 | 7.1 |
| 1.0 | 19 6 | 8.7 | 85.8 | 80 | 7 2 |
| 1 5 | 19 6 | 8.7 | 95.6 | 80 | 7 2 |
| 2 0 | 19 6 | 8 6 | 95.4 | 80 | 7.2 |
| 2 5 | 19.6 | 8 6 | 95.2 | 80 | 7.1 |
| 3 0 | 19.5 | 8 6 | 94.7 | 80 | 7.1 |
| 3.5 | 19.4 | 8 6 | 94.4 | 80 | 7 2 |
| 4 0 | 19.3 | 8.6 | 94 2 | 80 | 7 2 |
| 4 5 | *8 9 | 8.4 | 91 4 | 80 | 7 1 |
| 5 0 | 17 8 | 8 2 | 87 8 | 80 | 7 2 |
| 5.5 | 17 4 | 8.1 | 85.4 | 80 | 7.2 |
| 6.0 | 16 8 | 7.8 | 81.2 | 80 | 7.1 |
| 6.5 | 16 5 | 7 7 | 79 4 | 80 | 7.1 |
| 7 0 | 16 3 | 7 6 | 77.9 | 80 | 7 2 |
| 7 5 | *6 2 | 7.5 | 77.0 | 80 | 7.1 |
| 8 0 | 15 9 | 7.1 | 72.4 | 79 | 7 1 |
| 8 5 | 15 1 | 6.0 | 60.8 | 78 | 7.1 |
| 9.0 | 14 9 | 5 5 | 55 1 | 78 | 7.1 |
| 9 5 | 14 9 | 5 5 | 55.0 | 78 | 7.1 |
| 10.0 | 14.8 | 5.5 | 54.6 | 77 | 7 1 |
| 10.5 | 14.7 | 5.2 | 52.1 | 77 | 7 1 |
| 11.0 | 14 6 | 5.3 | 52.5 | 80 | 7.0 |
| 11.5 | 14 5 | 5.3 | 53.2 | 82 | 7.0 |
| 12.0 | 14.3 | 5 3 | 52 6 | 83 | 6.9 |
| 12.5 | 14.2 | 5 4 | 53 5 | 88 | 6.9 |
| 12.9 | 14.2 | 5 4 | 53.5 | 87 | 6.9 |

**16-Jun-04**

*Approximate air temp 28 8 C*
*Secchi Depth 5 0* *Time 1620*
*Winds NE 8-12 mph* *cool and breezy*
*Taken in Tailrace (TR1)*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 15.9 | 7 0 | 71 2 | 82 | 7.3 |
| 0 5 | 15.9 | 7 0 | 71 3 | 80 | 7.3 |
| 1 0 | 15.9 | 7 0 | 71 3 | 80 | 7 2 |
| 1.5 | 15 9 | 7 0 | 71 3 | 8* | 7 2 |
| 2 0 | 15 9 | 7.0 | 71.3 | 80 | 7.2 |
| 2.5 | 15 9 | 7.0 | 71.2 | 80 | 7 2 |
| 3.0 | 15.8 | 6.9 | 70.2 | 81 | 7 2 |
| 3.5 | 15.8 | 6.9 | 70 4 | 81 | 7.2 |
| 3.8 | 15.9 | 6 9 | 70 3 | 81 | 7.3 |

**16-Jun-04**

*Approximate air temp 28 8 C*
*Time 1520*
*Winds NE 8-12 mph* *cool and breezy*
*Taken on Tailrace (TR3) ~ 400' downstream*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 15 9 | 7.4 | 75 9 | 81 | 8 1 |
| 0 5 | 15.9 | 7 4 | 75 8 | 81 | 8 1 |
| 1.0 | *5 9 | 7.4 | 75 7 | 81 | 8 0 |

**16-Jun-04**

*Approximate air temp 28 8 C*
*Time 1615*
*Winds NE 8-12 mph* *cool and breezy*
*From drain pipe (TR2)*

| Depth (m) | Temp. (C) | D.O (mg/l) | D.O. % Saturation | Cond (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 8 5 | 0 6 | 4.7 | 186 | 7 2 |

**16-Jun-04**

*Approximate air temp 28 8 C*
*Time 1520*
*Winds NE 8-12 mph* *cool and breezy*
*Taken on Tainter Gate (TG1) side*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 19.1 | 8.9 | 97 2 | 82 | 7 8 |
| 0 5 | 19.1 | 8 9 | 97 1 | 82 | 7 8 |
| 1 0 | 19.1 | 8 9 | 97 0 | 82 | 7 8 |
| 1 3 | 19 1 | 8.9 | 97.0 | 82 | 7.8 |

TR1 - Taken in tailrace near plant
TR2 - Taken from a drain pipe at base of dam. Discharges into tailrace
TR3 - Taken in the tailrace approximate y 400' downstream of TR1
TG1 - Taken on Tainter Gate side of plant

[ ] Indicates opening of intake forebay (10-15 5m)

Tailrace data for same time period as vertical profile on 6/17/04

| Time | Temp C | DO (mg/l) | DO (% Sat) | Cond |
|---|---|---|---|---|
| 800 | 15 8 | 6 4 | 65 5 | 77 |
| 900 | 15 8 | 6.4 | 65.2 | 77 |
| 1000 | 16.0 | 6.5 | 66.5 | 77 |

pH was not a parameter collected in the tailrace

**1-Jul-04**

*Approximate air temp 18.3 C*
*Secchi Depth 6.0 Water depth ~40* *Time 0900*
*Winds Calm slightly north 0-3 mph* *no clouds bright sun*
*Taken in flowage*

| Depth (m) | Temp (C) | D.O. (mg/l) | D.O. % Saturation | Cond (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 19.1 | 8.9 | 97.8 | 83 | 7.3 |
| 0.5 | 19.1 | 8.8 | 97.2 | 83 | 7.3 |
| 1.0 | 19.0 | 8.8 | 96.5 | 83 | 7.3 |
| 1.5 | 18.9 | 8.8 | 96.0 | 83 | 7.3 |
| 2.0 | 18.8 | 8.7 | 95.5 | 83 | 7.3 |
| 2.5 | 18.8 | 8.7 | 95.0 | 83 | 7.3 |
| 3.0 | 18.7 | 8.7 | 94.5 | 82 | 7.3 |
| 3.5 | 18.7 | 8.6 | 94.3 | 83 | 7.2 |
| 4.0 | 18.7 | 8.6 | 93.8 | 82 | 7.2 |
| 4.5 | 18.7 | 8.6 | 93.6 | 82 | 7.3 |
| 5.0 | 18.4 | 8.4 | 91.0 | 84 | 7.2 |
| 5.5 | 18.3 | 8.4 | 90.6 | 83 | 7.2 |
| 6.0 | 17.9 | 8.2 | 88.0 | 83 | 7.1 |
| 6.5 | 17.8 | 8.2 | 87.7 | 83 | 7.1 |
| 7.0 | 17.8 | 8.2 | 87.5 | 83 | 7.1 |
| 7.5 | 17.5 | 8.0 | 84.9 | 83 | 7.1 |
| 8.0 | 17.3 | 7.8 | 83.1 | 85 | 7.1 |
| 8.5 | 17.2 | 7.6 | 80.9 | 84 | 7.1 |
| 9.0 | 17.2 | 7.6 | 80.5 | 85 | 7.1 |
| 9.5 | 17.2 | 7.6 | 80.3 | 85 | 7.0 |
| 10.0 | 17.1 | 7.5 | 79.5 | 85 | 7.0 |
| 10.5 | 17.0 | 7.5 | 79.0 | 85 | 7.0 |
| 11.0 | 16.9 | 7.4 | 77.3 | 87 | 7.0 |
| 11.5 | 16.8 | 7.3 | 76.5 | 91 | 7.0 |
| 12.0 | 16.7 | 7.1 | 74.3 | 95 | 7.0 |
| 12.5 | 16.4 | 6.8 | 71.1 | 104 | 7.0 |
| 13.0 | 16.3 | 6.7 | 69.2 | 109 | 7.0 |

**1-Jul-04**

*Approximate air temp 18.3 C*
*Secchi Depth 5.0* *Time 1100*
*Winds Calm slightly north 0-3 mph* *no clouds bright sun*
*Taken in Tailrace (TR1)*

| Depth (m) | Temp (C) | D.O. (mg/l) | D.O. % Saturation | Cond (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 17.7 | 8.5 | 90.7 | 85 | 7.3 |
| 0.5 | 17.7 | 8.4 | 90.2 | 85 | 7.2 |
| 1.0 | 17.7 | 8.4 | 89.9 | 85 | 7.2 |
| 1.5 | 17.7 | 8.4 | 89.7 | 85 | 7.2 |
| 2.0 | 17.7 | 8.4 | 89.4 | 85 | 7.2 |
| 2.5 | 17.7 | 8.3 | 88.8 | 85 | 7.2 |
| 3.0 | 17.7 | 8.3 | 88.6 | 85 | 7.2 |
| 3.4 | 17.7 | 8.3 | 88.6 | 85 | 7.2 |

**1-Jul-04**

*Approximate air temp 18.3 C*
*Time 1120*
*Winds Calm slightly north 0-3 mph* *no clouds bright sun*
*Taken in Tailrace (TR3 ~ 400' downstream*

| Depth (m) | Temp (C) | D.O. (mg/l) | D.O. % Saturation | Cond (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 17.7 | 8.2 | 87.9 | 85 | 7.1 |
| 0.5 | 17.7 | 8.2 | 88.0 | 85 | 7.1 |
| 1.0 | 17.7 | 8.2 | 88.0 | 85 | 7.1 |

**1-Jul-04**

*Approximate air temp 18.3 C*
*Time 1115*
*Winds Calm slightly north 0-3 mph* *no clouds bright sun*
*From drain pipe (TR2)*

| Depth (m) | Temp (C) | D.O. (mg/l) | D.O. % Saturation | Cond (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 9.0 | 0.4 | 3.7 | 188 | 7.2 |

**1-Jul-04**

*Approximate air temp 18.3 C*
*Time 1130*
*Winds Calm slightly north 0-3 mph* *no clouds bright sun*
*Taken on Tainter Gate (TG1) side*

| Depth (m) | Temp (C) | D.O. (mg/l) | D.O. % Saturation | Cond (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 20.0 | 8.3 | 92.6 | 135 | 7.4 |
| 0.5 | 18.5 | 8.1 | 88.1 | 134 | 7.3 |
| 1.0 | 17.0 | 7.9 | 84.1 | 181 | 7.3 |

TR1 - Taken in tailrace near plant
TR2 - Taken from a drain pipe at base of dam Discharges into tailrace
TR3 - Taken in the tailrace approximately 400' downstream of TR1
TG1 - Taken on Tainter Gate side of plant

[ ] Indicates opening of intake forebay (10-15.5m)

Tailrace data for same time period as vertical profile on 7/1/04

| Time | Temp C | DO (mg/l) | DO (% Sat) | Cond |
|---|---|---|---|---|
| 800 | 17.5 | 7.6 | 80.7 | 83 |
| 900 | 17.6 | 7.7 | 82.1 | 83 |
| 1000 | 17.6 | 7.7 | 81.5 | 83 |

pH was not a parameter collected in the tailrace

**15-Jul-04**

*Approximate air temp 21 1C*
*Secchi Depth 6 0 Water depth ~4* *Time 0900*
*Westerly winds 4-7 mph* *slight haze*
*Taken in flowage*

| Depth (m) | Temp. (C) | D O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0 0 | 20 2 | 8 8 | 99.2 | 88 | 7.6 |
| 0 5 | 20 3 | 8.8 | 99.2 | 88 | 7 6 |
| 1.0 | 20.1 | 8.8 | 99.0 | 88 | 7.6 |
| 1.5 | 19.9 | 8.6 | 97.4 | 88 | 7.5 |
| 2 0 | 19 7 | 8 4 | 93.4 | 88 | 7.5 |
| 2 5 | 19 6 | 8.3 | 92 4 | 88 | 7.5 |
| 3.0 | 19.5 | 9.3 | 92.5 | 88 | 7.4 |
| 3 5 | 19.4 | 8.2 | 90.6 | 88 | 7 4 |
| 4.0 | 19.3 | 8.1 | 89.3 | 87 | 7.3 |
| 4 5 | 19 7 | 8.0 | 87.9 | 88 | 7 3 |
| 5.0 | 18 9 | 7 9 | 86 1 | 88 | 7.3 |
| 5 5 | 18 4 | 7 6 | 81 9 | 90 | 7.2 |
| 6 0 | 18 2 | 7.4 | 79 7 | 91 | 7.2 |
| 6.5 | 18 1 | 7 2 | 77 4 | 89 | 7.2 |
| 7 0 | 17.9 | 7.1 | 75.9 | 91 | 7.1 |
| 7 5 | 17.7 | 6.8 | 72.8 | 91 | 7.1 |
| 8.0 | 17 3 | 6.5 | 69.0 | 91 | 7 1 |
| 8.5 | 17 2 | 6 4 | 68 3 | 93 | 7.0 |
| 9.0 | 17 4 | 6.6 | 69 9 | 92 | 7.0 |
| 9 5 | 17 3 | 6 5 | 68 5 | 95 | 7.0 |
| 10.0 | 17.2 | 6 4 | 68 2 | 95 | 7.0 |
| 10.5 | 17 1 | 6.4 | 67.8 | 94 | 7.0 |
| 11.0 | 17.1 | 6.3 | 65.3 | 97 | 6.9 |
| 11.5 | 16.4 | 5.9 | 61.5 | 114 | 6 9 |
| 12.0 | 16 3 | 5.9 | 61.2 | 117 | 6 9 |
| 12.5 | 16 3 | 5 9 | 60 8 | 118 | 6 9 |

**15-Jul-04**

*Approximate air temp 23 8C*
*Secchi Depth 5 5* *Time 1200*
*NW winds 4-7 mph* *20% clouds*
*Taken in Tailrace (TR1)*

| Depth (m) | Temp. (C) | D O. (mg/l) | D O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 13 9 | 9.2 | 91 5 | 103 | 7.4 |
| 0.5 | 13 9 | 9.0 | 89 7 | 102 | 7.4 |
| 1 0 | 13.7 | 9 1 | 88 6 | 103 | 7 3 |
| 1 5 | 13.6 | 9 1 | 87 4 | 103 | 7 3 |
| 2.0 | 13.7 | 8.9 | 89 3 | 103 | 7 3 |
| 2 5 | 13 7 | 8 8 | 87.3 | 104 | 7.3 |
| 3.0 | 13 7 | 8 9 | 86.5 | 105 | 7.2 |
| 3.3 | 13.6 | 8.9 | 86.7 | 105 | 7.2 |

**15-Jul-04**

*Approximate air temp 23 8C*
*Time 1212*
*NW winds 4-7 mph* *20% clouds*
*Taken in Tailrace (TR3) ~400 downstream*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0 0 | 17.6 | 7.3 | 81 0 | 94 | 7 1 |
| 0 5 | 17 6 | 7.5 | 80 0 | 94 | 7.1 |
| 1 0 | 17 6 | 7 4 | 79.4 | 94 | 7 0 |

**15-Jul-04**

*Approximate air temp 23 8C*
*Time 1200*
*NW winds 4-7 mph* *20% clouds*
*From drain pipe (TR2)*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0 1 | 9.8 | 0.8 | 6 8 | 18.9 | 7 3 |

**15-Jul-04**

*Approximate air temp 23 8C*
*Time 1212*
*NW winds 4 7 mph* *20% clouds*
*Taken on Tainter Gate (TG1) side*

| Depth (m) | Temp. (C) | D.O (mg/l) | D O % Saturation | Cond (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 21.7 | 8.4 | 95 9 | 140 | 7 3 |
| 0 5 | 20.7 | 8 1 | 92.5 | 149 | 7.3 |
| 1.0 | 18.7 | 8.0 | 88.3 | 191 | 7.3 |

TR1 - Taken in tailrace near plant
TR2 - Taken from a drain pipe at base of dam Discharges into tailrace
TR3 - Taken in the tailrace approximately 400' downstream of TR1
TG1 - Taken on Tainter Gate side of plant

☐ Indicates opening of intake forebay (10-15.5m)

Tailrace data for same time period as vertical profile on 7/15/04

| Time | Temp C | DO (mg/l) | DO (% Sat) | Cond |
|---|---|---|---|---|
| 800 | 17.8 | 7.1 | 75.3 | 91 |
| 900 | 17 7 | 7 2 | 76.2 | 93 |
| 1000 | 17 5 | 7.1 | 74.9 | 94 |

pH was not a parameter collected in the tailrace

**30-Jul-04**

*Approximate air temp. 23.8 C*
*Secci Depth 7.0 Water depth ~40'* *Time 0915*
*SNE winds 3-7 mph* *clear blue sky*
*Taken in flowage*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 21.5 | 8.2 | 94.8 | 97 | 7.4 |
| 0.5 | 21.5 | 8.2 | 94.0 | 97 | 7.4 |
| 1.0 | 21.4 | 8.1 | 93.4 | 97 | 7.4 |
| 1.5 | 21.3 | 8.1 | 93.2 | 97 | 7.4 |
| 2.0 | 21.3 | 8.1 | 92.7 | 97 | 7.4 |
| 2.5 | 21.3 | 8.0 | 92.1 | 97 | 7.4 |
| 3.0 | 21.3 | 7.9 | 90.4 | 96 | 7.4 |
| 3.5 | 21.2 | 7.8 | 89.5 | 97 | 7.3 |
| 4.0 | 21.0 | 7.0 | 80.6 | 98 | 7.2 |
| 4.5 | 20.5 | 6.4 | 73.0 | 100 | 7.1 |
| 5.0 | 19.2 | 4.9 | 54.0 | 102 | 6.9 |
| 5.5 | 18.7 | 4.4 | 48.4 | 103 | 6.9 |
| 6.0 | 18.4 | 4.1 | 44.1 | 100 | 6.9 |
| 6.5 | 18.0 | 3.7 | 39.4 | 103 | 6.8 |
| 7.0 | 17.7 | 3.3 | 34.9 | 104 | 6.8 |
| 7.5 | 17.4 | 2.9 | 30.5 | 104 | 6.8 |
| 8.0 | 17.2 | 2.8 | 29.4 | 105 | 6.7 |
| 8.5 | 17.0 | 2.6 | 26.9 | 106 | 6.7 |
| 9.0 | 16.9 | 2.4 | 25.2 | 106 | 6.7 |
| 9.5 | 16.9 | 2.4 | 25.1 | 106 | 6.8 |
| 10.0 | 16.7 | 2.1 | 22.2 | 108 | 6.8 |
| 10.5 | 16.6 | 2.0 | 20.7 | 110 | 6.7 |
| 11.0 | 16.6 | 1.9 | 20.1 | 110 | 6.7 |
| 11.5 | 16.4 | 1.7 | 17.9 | 112 | 6.7 |
| 12.0 | 16.3 | 1.6 | 17.1 | 112 | 6.7 |
| 12.5 | 16.3 | 1.6 | 16.7 | 114 | 6.7 |
| 12.7 | bottom | | | | |

Indicates opening of intake forebay (10-15.5m)

Tailrace data for same time period as vertical profile on 7/30/04

| Time | Temp C | DO (mg/l) | DO (% Sat) | Conc |
|---|---|---|---|---|
| 800 | 16.5 | 2.4 | 24.5 | 106 |
| 900 | 16.5 | 2.4 | 24.5 | 107 |
| 1000 | 16.6 | 2.4 | 24.9 | 107 |

pH was not a parameter collected in the tailrace.

**29-Jul-04**

*Approximate air temp. 23.8C*
*Time 1021*
*WSW winds 8-12 mph* *100 % overcast*
*Taken in Tailrace (TR1)*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 16.6 | 2.6 | 27.4 | 113 | 7.1 |
| 0.5 | 16.6 | 2.6 | 27.2 | 113 | 7.1 |
| 1.0 | 16.5 | 2.6 | 26.9 | 113 | 7.1 |
| 1.5 | 16.5 | 2.6 | 26.9 | 113 | 7.1 |
| 2.0 | 16.5 | 2.5 | 26.6 | 113 | 7.1 |
| 2.5 | 16.5 | 2.5 | 26.5 | 113 | 7.0 |
| 3.0 | 16.5 | 2.4 | 25.2 | 114 | 7.1 |
| 3.4 | 16.4 | 2.4 | 25.2 | 115 | 7.1 |

**29-Jul-04**

*Approximate air temp. 23.8C*
*Time 1040*
*WSW winds 8-12 mph* *100 % overcast*
*Taken in Tailrace (TR3) ~400 downstream*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 17.4 | 4.1 | 43.1 | 102 | 6.9 |
| 0.5 | 16.8 | 3.0 | 31.9 | 112 | 6.9 |
| 1.0 | 16.6 | 2.6 | 27.5 | 112 | 6.9 |
| 1.4 | 16.5 | 2.6 | 26.6 | 112 | 6.9 |

**29-Jul-04**

*Approximate air temp. 23.8C*
*Time 1021*
*WSW winds 8-12 mph* *100 % overcast*
*From drain pipe (TR2)*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.1 | 10.5 | 0.4 | 3.7 | 192 | 7.4 |

**29-Jul-04**

*Approximate air temp. 23.8C*
*Time 1050*
*WSW winds 8-12 mph* *100 % overcast*
*Taken in Tailrace TR4*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.7 | 6.0 | 62.6 | 103 | 7.1 |
| 0.5 | 18.8 | 6.2 | 70.0 | 102 | 7.1 |
| 0.7 | 16.8 | 3.0 | 31.3 | 111 | 6.9 |

**29-Jul-04**

*Approximate air temp. 23.8C*
*Time 1050*
*WSW winds 8-12 mph* *100 % overcast*
*Taken in Tailrace (TR5)*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.9 | 6.4 | 69.4 | 102 | 7.1 |
| 0.5 | 18.4 | 5.7 | 62.5 | 104 | 7.0 |
| 0.7 | 17.6 | 4.1 | 44.7 | 106 | 7.0 |

TR1 - Taken in tailrace near plant
TR2 - Taken from a drain pipe at base of dam. Discharges into tailrace
TR3 - Taken in the tailrace approximately 400' downstream of TR1
TR4– Taken in tailrace just prior to tailrace and tainter gate section combination. Nearest island.
TR5– Taken in tailrace just prior to tailrace and tainter gate section combination. Middle of stream
TR6– Taken in tailrace just prior to tailrace and tainter gate section combination. Near north shore
TG1 - Taken on Tainter Gate side of plant

| 29-Jul-04 | | | | | |
|---|---|---|---|---|---|
| *Approximate air temp 23.8C* | | | | | |
| | | | | *Time 1100* | |
| *WSW winds 8 12 mph* | | | | *100 % overcast* | |
| *Taken in Tailrace (TR6)* | | | | | |
| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O % Saturation | Cond. (uS/cm) | pH (S.U.) |
| 0.0 | 19.6 | 7 7 | 88.3 | 98 | 7.2 |
| 0.5 | 19 8 | 8.0 | 86.6 | 99 | 7 3 |
| 0 9 | 18 3 | 5.1 | 52.1 | 105 | 7 0 |

| 29-Jul-04 | | | | | |
|---|---|---|---|---|---|
| *Approximate air temp 23 8C* | | | | | |
| | | | | *Time:1100* | |
| *WSW winds 8-12 mph* | | | | *100 % overcast* | |
| *Taken on Tainter Gate (TG1) side* | | | | | |
| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
| 0 0 | 20.1 | 9 1 | 101.5 | 97 | 7.2 |
| 0 5 | 20.1 | 8 9 | 10.3 | 97 | 7.3 |
| 1.4 | 20.1 | 8 9 | 99.3 | 99 | 7.3 |

**12-Aug-04**

*Approximate air temp. 11.6 C*
*Secci Depth 5.5 Water depth ~40'* *Time 0900*
*NW winds 8-12 mph* *10-20% clouds*
*Taken in flowage* *blue sky*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.8 | 7.0 | 75.8 | 105 | 7.3 |
| 0.5 | 18.8 | 6.9 | 74.3 | 105 | 7.3 |
| 1.0 | 18.8 | 6.9 | 75.2 | 105 | 7.3 |
| 1.5 | 18.8 | 6.9 | 75.4 | 105 | 7.3 |
| 2.0 | 18.8 | 6.9 | 74.3 | 105 | 7.3 |
| 2.5 | 18.7 | 6.7 | 72.8 | 105 | 7.3 |
| 3.0 | 18.8 | 6.8 | 75.1 | 105 | 7.3 |
| 3.5 | 18.8 | 6.9 | 75.9 | 105 | 7.3 |
| 4.0 | 18.8 | 6.9 | 75.7 | 105 | 7.3 |
| 4.5 | 18.8 | 6.9 | 75.1 | 105 | 7.3 |
| 5.0 | 18.8 | 6.9 | 75.4 | 105 | 7.3 |
| 5.5 | 18.7 | 6.7 | 72.4 | 105 | 7.3 |
| 6.0 | 18.7 | 6.8 | 13.3 | 105 | 7.2 |
| 6.5 | 18.7 | 6.6 | 73.0 | 105 | 7.2 |
| 7.0 | 18.7 | 6.6 | 71.6 | 105 | 7.2 |
| 7.5 | 18.7 | 6.5 | 70.1 | 105 | 7.2 |
| 8.0 | 18.7 | 6.7 | 72.2 | 105 | 7.2 |
| 8.5 | 18.7 | 6.5 | 70.1 | 105 | 7.2 |
| 9.0 | 18.5 | 5.8 | 60.9 | 105 | 7.2 |
| 9.5 | 17.5 | 1.3 | 10.0 | 110 | 7.0 |
| 10.0 | 17.2 | 0.8 | 6.9 | 109 | 6.9 |
| 10.5 | 17.0 | 0.5 | 4.8 | 110 | 6.9 |
| 11.0 | 17.0 | 0.5 | 3.9 | 110 | 6.8 |
| 11.5 | 16.5 | 0.2 | 1.6 | 115 | 6.8 |
| 12.0 | 16.3 | 0.1 | 1.4 | 115 | 6.8 |

**12-Aug-04**

*Approximate air temp. 15.5C*
*Time 1115*
*NW winds 8-12 mph* *10-30% clouds*
*Taken in Tailrace (TR1)* *sunny day*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 16.7 | 3.9 | 41.3 | 112 | 7.1 |
| 0.5 | 16.7 | 3.9 | 40.9 | 112 | 7.1 |
| 1.0 | 16.7 | 3.9 | 40.7 | 112 | 7.0 |
| 1.5 | 16.7 | 3.9 | 40.7 | 112 | 7.0 |
| 2.0 | 16.7 | 3.9 | 40.5 | 112 | 7.0 |
| 2.5 | 16.7 | 3.9 | 40.5 | 112 | 7.0 |
| 3.0 | 16.7 | 3.8 | 38.7 | 112 | 7.0 |
| 3.4 | 16.7 | 3.7 | 38.9 | 113 | 7.0 |

**12-Aug-04**

*Approximate air temp. 15.5C*
*Time 1130*
*NW winds 8-12 mph* *10-30% clouds*
*From drain pipe (TR2)* *sunny day*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 10.7 | 0.6 | 4.1 | 193 | 6.9 |

**12-Aug-04**

*Approximate air temp. 15.5C*
*Time 1135*
*NW winds 8-12 mph* *10-30% clouds*
*Taken in Tailrace (TR3) ~400' downstream* *sunny day*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.6 | 5.7 | 60.2 | 108 | 7.0 |
| 0.5 | 17.6 | 4.5 | 48.2 | 111 | 7.0 |
| 1.0 | 16.8 | 4.3 | 45.2 | 112 | 6.9 |
| 1.2 | 16.4 | 5.1 | 52.7 | 111 | 7.0 |

**12-Aug-04**

*Approximate air temp. 15.5C*
*Time 1143*
*NW winds 8-12 mph* *10-30% clouds*
*TR4*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.8 | 7.9 | 86.4 | 106 | 7.2 |
| 0.5 | 17.9 | 5.8 | 61.0 | 109 | 7.1 |
| 1.0 | 16.9 | 5.2 | 55.2 | 109 | 7.0 |

**12-Aug-04**

*Approximate air temp. 15.5C*
*Time 1148*
*NW winds 8-12 mph* *10-30% clouds*
*TR5*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.5 | 7.7 | 85.1 | 106 | 7.2 |
| 0.5 | 18.2 | 7.2 | 78.5 | 107 | 7.2 |
| 0.6 | 18.0 | 6.2 | 65.1 | 112 | 7.1 |

Indicates opening of intake forebay (10-15.5m)

Tailrace data for same time period as vertical profile on 8/12/04

| Time | Temp C | DO (mg/l) | DO (% Sat) | Cond |
|---|---|---|---|---|
| 800 | 16.3 | 3.4 | 35.2 | 108 |
| 900 | 16.4 | 3.5 | 35.7 | 108 |
| 1000 | 16.5 | 3.5 | 36.3 | 108 |

pH was not a parameter collected in the tailrace

TR1 - Taken in tailrace near plant
TR2 - Taken from a drain pipe at base of dam. Discharges into tailrace
TR3 - Taken in the tailrace approximately 400' downstream of TR1
TR4-- Taken in tailrace just prior to tailrace and tainter gate section combination. Nearest island
TR5-- Taken in tailrace just prior to tailrace and tainter gate section combination. Middle of stream.
TR6-- Taken in tailrace just prior to tailrace and tainter gate section combination. Near north shore
TG1 - Taken on Tainter Gate side of plant

**12-Aug-04**

*Approximate air temp 15.5C*

*Time 1155*
*NW winds 8-12 mph*
*10-30% clouds*
*TR6*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0 1 | 18.7 | 8.3 | 91 8 | 106 | 7.3 |
| 0.5 | 18.6 | 8.1 | 87 9 | 106 | 7.2 |
| 1.1 | 17 3 | 6.0 | 69.7 | 109 | 7.1 |

*Approximate air temp 15.5C*

*Time.1206*
*NW winds 8-12 mph*
*10-30% clouds*
*WSW winds 8 12 mph*
*100 % overcast*
*Taken on Tainter Gate (1G1) side*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 19 0 | 8 9 | 98.2 | 105 | 7 3 |
| 0 5 | 19 0 | 8 9 | 98.3 | 105 | 7 4 |
| 1.0 | 19 0 | 8 9 | 98.7 | 105 | 7.4 |

**26-Aug-04**

*Approximate air temp. 20 C*
*Secci Depth 7.0' Water depth ~40* *Time 0830*
*WSW 4-7 mph, humid* *100% overcast*
*Taken in Flowage* *Threat of rain*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.6 | 8.7 | 95.1 | 110 | 7.6 |
| 0.5 | 18.4 | 8.6 | 93.2 | 110 | 7.6 |
| 1.0 | 18.3 | 8.5 | 91.9 | 111 | 7.6 |
| 1.5 | 18.2 | 8.3 | 89.5 | 111 | 7.6 |
| 2.0 | 18.1 | 8.2 | 88.4 | 112 | 7.6 |
| 2.5 | 18.0 | 8.1 | 87.4 | 112 | 7.6 |
| 3.0 | 17.9 | 8.0 | 86.5 | 112 | 7.5 |
| 3.5 | 17.9 | 8.0 | 86.2 | 113 | 7.5 |
| 4.0 | 17.9 | 8.0 | 85.8 | 113 | 7.5 |
| 4.5 | 17.9 | 8.0 | 85.4 | 113 | 7.5 |
| 5.0 | 17.9 | 7.9 | 84.9 | 113 | 7.5 |
| 5.5 | 17.8 | 7.9 | 84.4 | 113 | 7.5 |
| 6.0 | 17.8 | 7.8 | 84.1 | 113 | 7.5 |
| 6.5 | 17.8 | 7.8 | 84.1 | 114 | 7.5 |
| 7.0 | 17.8 | 7.6 | 82.3 | 113 | 7.5 |
| 7.5 | 17.8 | 7.8 | 83.7 | 113 | 7.5 |
| 8.0 | 17.8 | 7.6 | 81.6 | 113 | 7.5 |
| 8.5 | 17.8 | 7.7 | 82.2 | 112 | 7.4 |
| 9.0 | 17.8 | 7.7 | 82.7 | 112 | 7.5 |
| 9.5 | 17.7 | 7.7 | 82.1 | 113 | 7.4 |
| 10.0 | 17.7 | 7.4 | 79.5 | 113 | 7.4 |
| 10.5 | 17.6 | 6.7 | 71.8 | 113 | 7.4 |
| 11.0 | 17.3 | 4.6 | 47.7 | 114 | 7.3 |
| 11.5 | 17.2 | 4.2 | 44.3 | 117 | 7.2 |
| 12.0 | 17.0 | 3.4 | 35.6 | 119 | 7.2 |
| 12.5 | 16.6 | 2.0 | 21.4 | 125 | 7.1 |

**26-Aug-04**

*Approximate air temp. 21.1C*
*Time 1030*
*WSW 4-7 mph* *100% overcast*
*Taken in Tailrace (TR1:* *threat of rain*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 19.0 | 7.5 | 81.9 | 118 | 7.4 |
| 0.5 | 18.7 | 7.3 | 79.3 | 118 | 7.4 |
| 1.0 | 18.0 | 6.6 | 72.1 | 118 | 7.4 |
| 1.5 | 17.9 | 6.5 | 69.0 | 117 | 7.3 |
| 2.0 | 17.7 | 6.2 | 66.0 | 117 | 7.3 |
| 2.5 | 17.7 | 6.2 | 66.9 | 115 | 7.3 |
| 2.9 | 17.6 | 6.3 | 67.1 | 115 | 7.3 |

**26-Aug-04**

*Approximate air temp. 21.1C*
*Time 1050*
*WSW 4-7 mph* *100% overcast*
*Taken in Tailrace (TR3)* *threat of rain*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 17.8 | 7.2 | 76.9 | 114 | 7.3 |
| 0.5 | 17.8 | 7.2 | 76.8 | 115 | 7.2 |
| 1.0 | 17.9 | 7.7 | 83.3 | 112 | 7.3 |

**26-Aug-04**

*Approximate air temp. 21.1C*
*Time 1030*
*WSW 4-7 mph* *100% overcast*
*From drain pipe (TR2)* *threat of rain*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 11.0 | 0.5 | 4.6 | 193 | 7.2 |

**26-Aug-04**

*Approximate air temp. 21.1C*
*Time 1100*
*WSW 4-7 mph* *100% overcast*
*Taken on Tainter Gate (TG1) side* *threat of rain*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.1 | 9.0 | 97.5 | 112 | 7.5 |
| 0.5 | 18.2 | 9.0 | 97.5 | 112 | 7.5 |
| 1.0 | 18.1 | 9.0 | 97.8 | 112 | 7.5 |

TR1 -Taken in tailrace near plant
TR2 - Taken from a drain pipe at base of dam. Discharges into tailrace
TR3 - Taken in the tailrace approximately 400' downstream of TR1
TG1 - Taken on Tainter Gate side of plant

☐ Indicates opening of intake forebay (10-15.5m)

Tailrace data for same time period as vertical profile on 8/26/04

| Time | Temp C | DO (mg/l) | DO (% Sat) | Cond |
|---|---|---|---|---|
| 800 | 18.4 | 6.1 | 65.8 | 116 |
| 900 | 18.3 | 5.6 | 60.4 | 117 |
| 1000 | 18.2 | 5.6 | 60.3 | 117 |

pH was not a parameter collected in the tailrace

**9-Sep-04**

*Approximate air temp. 10 C*
*Secci Depth 6.0' Water depth ~ 35-40'* *Time 0900*
*Calm no clouds*
*Taken in Flowage*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.6 | 8.2 | 88.4 | 119 | 7.7 |
| 0.5 | 18.6 | 8.2 | 89.5 | 119 | 7.6 |
| 1.0 | 18.6 | 8.2 | 88.3 | 119 | 7.4 |
| 1.5 | 18.5 | 8.4 | 90.5 | 119 | 7.3 |
| 2.0 | 18.5 | 8.2 | 87.9 | 119 | 7.3 |
| 2.5 | 18.5 | 8.1 | 87.5 | 118 | 7.2 |
| 3.0 | 18.5 | 8.1 | 87.3 | 118 | 7.2 |
| 3.5 | 18.5 | 8.0 | 86.8 | 118 | 7.2 |
| 4.0 | 18.4 | 8.0 | 85.8 | 118 | 7.1 |
| 4.5 | 18.4 | 8.0 | 85.7 | 118 | 7.1 |
| 5.0 | 18.4 | 7.9 | 85.4 | 118 | 7.1 |
| 5.5 | 18.4 | 7.9 | 85.0 | 118 | 7.1 |
| 6.0 | 18.4 | 7.9 | 84.6 | 118 | 7.1 |
| 6.5 | 18.3 | 7.8 | 83.7 | 118 | 7.0 |
| 7.0 | 18.3 | 7.7 | 83.2 | 118 | 7.0 |
| 7.5 | 18.3 | 7.7 | 82.2 | 118 | 7.0 |
| 8.0 | 18.2 | 7.6 | 81.2 | 118 | 7.0 |
| 8.5 | 18.2 | 7.3 | 78.5 | 118 | 7.0 |
| 9.0 | 18.2 | 7.3 | 78.5 | 118 | 7.0 |
| 9.5 | 18.1 | 7.3 | 78.2 | 118 | 7.0 |
| 10.0 | 18.1 | 7.1 | 76.3 | 118 | 6.9 |
| 10.5 | 18.1 | 7.1 | 75.6 | 118 | 6.9 |
| 11.0 | 18.0 | 6.8 | 72.2 | 118 | 6.9 |
| 11.5 | 17.9 | 6.2 | 65.9 | 119 | 6.8 |
| 12.0 | 17.3 | 3.9 | 41.2 | 127 | 6.7 |

**9-Sep-04**

*Approximate air temp. 15.5 C* *Time 1050*
*Calm no clouds*
*Taken in Tailrace (TR1)*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.3 | 8.5 | 91.4 | 120 | 7.6 |
| 0.5 | 18.3 | 8.4 | 90.1 | 120 | 7.5 |
| 1.0 | 18.3 | 8.4 | 90.1 | 120 | 7.4 |
| 1.5 | 18.3 | 8.4 | 89.8 | 119 | 7.4 |
| 2.0 | 18.3 | 8.3 | 89.6 | 119 | 7.4 |
| 2.5 | 18.3 | 8.3 | 89.3 | 119 | 7.4 |
| 3.0 | 18.3 | 8.3 | 89.4 | 119 | 7.3 |
| 3.5 | 18.3 | 8.3 | 89.5 | 119 | 7.3 |
| 4.0 | 18.3 | 8.3 | 89.3 | 119 | 7.3 |
| 4.5 | 18.3 | 8.3 | 88.9 | 119 | 7.3 |
| 5.0 | 18.3 | 8.3 | 89.2 | 119 | 7.3 |
| 5.5 | 18.3 | 8.3 | 89.1 | 119 | 7.2 |
| 6.0 | 18.3 | 8.3 | 89.0 | 119 | 7.2 |

**9-Sep-04**

*Approximate air temp. 15.5 C* *Time 1100*
*Calm no clouds*
*Taken from Pipe (TR2)*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 11.6 | 0.9 | 7.5 | 182 | 7.1 |

**9-Sep-04**

*Approximate air temp. 15.5 C* *Time 1100*
*Calm no clouds*
*Taken in Tailrace (TR3)*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.3 | 8.4 | 90.2 | 120 | 7.7 |
| 0.5 | 18.3 | 8.4 | 90.1 | 120 | 7.5 |
| 1.0 | 18.3 | 8.4 | 90.1 | 120 | 7.5 |

**9-Sep-04**

*Approximate air temp. 15.5 C* *Time 1120*
*Calm no clouds*
*Taken on Tainter Gate (TG1) side*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 17.4 | 8.5 | 89.3 | 135 | 7.9 |
| 0.5 | 16.4 | 8.7 | 90.2 | 147 | 7.9 |
| 1.0 | 14.5 | 8.7 | 86.4 | 205 | 7.8 |

TR1 - Taken in tailrace near plant
TR2 - Taken from a drain pipe at base of dam. Discharges into tailrace
TR3 - Taken in the tailrace approximately 400' downstream of TR1
TG1 - Taken on Tainter Gate side of plant.

[ ] indicates opening of intake forebay (10-15.5m)

Tailrace data for same time period as vertical profile on 9/9/04

| Time | Temp C | DO (mg/l) | DO (% Sat) | Cond |
|---|---|---|---|---|
| 800 | 18.2 | 8.4 | 90.8 | 116 |
| 900 | 18.2 | 8.4 | 90.4 | 115 |
| 1000 | 18.2 | 8.3 | 89.8 | 120 |

pH was not a parameter collected in the tailrace.

**23-Sep-04**

*Secci Depth 8.0' Water depth 36-39' Time 0840*
*SSW 0-3 mph' 40% clouds*
*Taken in Flowage*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.3 | 8.6 | 92.2 | 122 | 8.0 |
| 0.5 | 18.3 | 8.6 | 92.2 | 122 | 8.0 |
| 1.0 | 18.2 | 8.6 | 82.2 | 122 | 8.0 |
| 1.5 | 18.2 | 8.5 | 90.2 | 122 | 8.0 |
| 2.0 | 18.2 | 8.5 | 90.6 | 122 | 8.0 |
| 2.5 | 18.2 | 8.3 | 89.2 | 122 | 8.0 |
| 3.0 | 18.2 | 8.3 | 88.4 | 122 | 8.0 |
| 3.5 | 18.1 | 8.2 | 88.2 | 122 | 8.0 |
| 4.0 | 18.1 | 8.3 | 88.5 | 122 | 8.0 |
| 4.5 | 18.1 | 8.2 | 87.2 | 122 | 7.9 |
| 5.0 | 18.0 | 8.0 | 85.6 | 123 | 7.9 |
| 5.5 | 18.0 | 7.8 | 83.8 | 123 | 7.9 |
| 6.0 | 18.0 | 7.7 | 82.6 | 123 | 7.8 |
| 6.5 | 17.9 | 7.6 | 80.9 | 124 | 7.8 |
| 7.0 | 17.9 | 7.5 | 80.0 | 124 | 7.8 |
| 7.5 | 17.8 | 7.5 | 79.5 | 125 | 7.7 |
| 8.0 | 17.8 | 7.4 | 78.7 | 125 | 7.7 |
| 8.5 | 17.8 | 7.3 | 77.5 | 124 | 7.7 |
| 9.0 | 17.7 | 7.2 | 76.7 | 124 | 7.7 |
| 9.5 | 17.7 | 7.2 | 76.7 | 124 | 7.7 |
| 10.0 | 17.6 | 7.0 | 74.3 | 129 | 7.7 |
| 10.5 | 17.5 | 6.5 | 68.9 | 130 | 7.6 |
| 11.0 | 17.3 | 5.4 | 56.7 | 134 | 7.5 |
| 11.5 | 17.3 | 4.9 | 51.9 | 140 | 7.4 |
| 11.9 | 17.2 | 4.2 | 43.8 | 141 | 7.3 |

Indicates opening of intake forebay (10-15.5m)

**23-Sep-04**

*Secci Depth 6.0' 36.39' Time 1030*
*southerly breeze 30% clouds*
*Taken in Tailrace (TR1*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 17.9 | 8.6 | 91.4 | 124 | 7.7 |
| 0.5 | 17.9 | 8.4 | 91.3 | 124 | 7.8 |
| 1.0 | 17.9 | 8.4 | 80.2 | 124 | 7.8 |
| 1.5 | 17.9 | 8.5 | 90.9 | 124 | 7.8 |
| 2.0 | 17.9 | 8.5 | 90.8 | 124 | 7.8 |
| 2.5 | 17.9 | 8.4 | 89.3 | 124 | 7.8 |
| 3.0 | 18.0 | 8.5 | 91.1 | 124 | 7.8 |
| 3.5 | 18.0 | 8.6 | 81.0 | 124 | 7.8 |
| 4.0 | 18.0 | 8.5 | 90.8 | 125 | 7.8 |
| 4.5 | 17.9 | 8.5 | 90.3 | 124 | 7.8 |
| 5.0 | 17.9 | 8.5 | 89.9 | 124 | 7.8 |

**23-Sep-04**

*Time 1045*
*southerly breeze 30% clouds*
*Taken from Pipe (TR2:*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 11.6 | 0.7 | | 197 | 7.3 |

**23-Sep-04**

*Time 1055*
*southerly breeze 30% clouds*
*Taken in Tailrace (TR3:*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 18.0 | 8.7 | 92.9 | 125 | 7.7 |
| 0.5 | 18.0 | 8.6 | 92.1 | 125 | 7.7 |
| 1.0 | 18.0 | 8.7 | 92.9 | 125 | 7.7 |

**23-Sep-04**

*Time 1120*
*southerly breeze 30% clouds*
*Taken on Tainter Gate (TG1) side*

| Depth (m) | Temp. (C) | D.O. (mg/l) | D.O. % Saturation | Cond. (uS/cm) | pH (S.U.) |
|---|---|---|---|---|---|
| 0.0 | 17.3 | 8.2 | 86.6 | 160 | 8.0 |
| 0.5 | 17.0 | 8.2 | 86.4 | 162 | 8.0 |
| 1.0 | 15.6 | 8.1 | 82.0 | 207 | 7.9 |

TR1 - Taken in tailrace near plant
TR2 - Taken from a drain pipe at base of dam. Discharges into tailrace
TR3 - Taken in the tailrace approximately 400' downstream of TR1
TG1 - Taken on Tainter Gate side of plant