STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C. L. "Butch" Otter, Governor
Curt A. Fransen, Director

August 6, 2012

Mr. Michael Lidgard
US Environmental Protection Agency, Region 10
1200 6th Avenue, OW-130
Seattle, Washington 98101

RE: FINAL §401 Water Quality Certification for the Revised Draft NPDES Permit No. ID-0021261 for the City of Idaho Falls

Dear Mr. Lidgard:

The State of Idaho Department of Environmental Quality (DEQ) received a revised preliminary draft National Pollutant Discharge Elimination Program (NPDES) permit for the city of Idaho Falls' discharge from their existing Wastewater Treatment Plant.

After review of the revised permit, public comments and revised effluent limitation calculations, DEQ submits the final § 401 water quality certification. Also enclosed are DEQ's antidegradation review (ADR) and an insignificance analysis conducted by the city of Idaho Falls, supporting DEQ's (ADR). The enclosed §401 certification supersedes all draft certifications.

Please direct any questions to Troy Saffle at 208.528.2650 or troy.saffle@deq.idaho.gov.

Sincerely,

Erick Neher
Regional Administrator
Idaho Falls Regional Office

Enclosures (3)

c: Doug Conde, Deputy Attorney General, TRIM References
Barry Burnell, Water Quality Division Administrator, TRIM References
Brian Nickel, EPA Region 10, Seattle, w/enclosures
Don Essig, TRIM References
Miranda Adams, TRIM References

Idaho Department of Environmental Quality

FINAL §401 Water Quality Certification

August 6, 2012

NPDES Permit Number: **ID-0021261** City of Idaho Falls

Pursuant to the provisions of Section 401(a)(1) of the Federal Water Pollution Control Act (Clean Water Act), as amended, 33 USC Section 1341 (a)(1), the Idaho Department of Environmental Quality (DEQ) has authority to review National Pollution Discharge Elimination System (NPDES) permits and issue a water quality certification decision.

DEQ reviewed the preliminary draft NPDES permit and associated fact sheet for the above-referenced facility. Based upon its review and consideration of this information, DEQ certifies that if the permittee complies with the terms and conditions imposed by the above-referenced permit along with the conditions set forth in this water quality certification, then there is reasonable assurance the discharge(s) will comply with the applicable requirements of Sections 301, 302, 303, 306, and 307 of the Clean Water Act, including the Idaho Water Quality Standards (IDAPA 58.01.02) and other appropriate requirements of state water quality law.

This certification does not constitute authorization of the permitted activities by any other state or federal agency or private person or entity. This certification does not excuse the permit holder from the obligation to obtain any other necessary approvals, authorizations or permits.

CONDITIONS THAT ARE NECESSARY TO ASSURE COMPLIANCE WITH WATER QUALITY STANDARDS OR OTHER APPROPRIATE WATER QUALITY REQUIREMENTS OF STATE LAW

MONITORING

In addition to monitoring required by the NPDES permit, the City shall conduct the following monitoring to ensure compliance with Idaho WQS and antidegradation procedures and policies:

1. Continuous in-stream temperature monitoring above and below outfall 001; and
2. Weekly pH monitoring above and below the outfall 001; pH monitoring shall also occur when any ammonia samples are collected.

The data shall be collected using an EPA compliant, DEQ reviewed Quality Assurance Project Plan (QAPP) and a DEQ reviewed Sampling and Analysis Plan (SAP). Annual data summaries shall be provided to EPA Region 10 and the DEQ Idaho Falls Regional

Office. The City shall submit the QAPP and the SAP to DEQ for comment prior to implementing the permit monitoring requirements.

FECAL COLIFORM BACTERIA

The deletion of fecal coliform effluent limits and the inclusion of *E. coli* effluent limits are consistent with IDAPA 58.01.02 and protective of the surface water quality, and therefore, DEQ certifies these changes to the permit.

MIXING ZONES

Pursuant to IDAPA 58.01.02.060, DEQ authorizes the use of the mixing zones as described in the table set out below for the following pollutants: ammonia, chlorine, nitrate, chromium, copper, lead, silver, chloroform, dichlorobromomethane, and whole effluent toxicity (WET). No mixing zones are authorized for zinc or toluene

Pollutant	**Mixing Zone (%)**	
ammonia (see below)		
	June-Sept	5
	Oct-May	15
chlorine	25	
nitrate	25	
chromium	25	
copper	25	
lead	25	
silver	25	
total phosphorus (see below)	52.5	
chloroform,	25	
dichlorobromomethane	25	
WET (whole effluent toxicity)	25	

AMMONIA LIMITATIONS

DEQ authorizes revised ammonia effluent limits, which are consistent with Idaho WQS and are determined to be Insignificant under Idaho's Antidegradation Rules (see below) Those limits are: 3.8 mg/L AML and 14.1 mg/L Maximum Daily Limit (MDL) June through September; and 3.4 mg/L AML and 12.3 mg/L MDL October through May. Because ammonia criteria vary with water temperature and pH, DEQ also authorizes two mixing zones based on seasonality: 5% for June through September and 15% for October through May.

TOTAL PHOSPHORUS LIMITATIONS

DEQ authorizes a 52.5% mixing zone for total phosphorus. DEQ believes that mixing zones for pollutants such as phosphorus should be analyzed differently than mixing zones for toxic pollutants and that a mixing zone for phosphorus using 100% of the volume of the stream flow may be appropriate for certain discharges. DEQ also believes, however, that mixing zones should be kept as small as practicable. The City of Idaho Falls can maintain its existing load of phosphorus and meet water quality targets with a 52.5% mixing zone, and therefore, a larger mixing zone is not needed. DEQ is certifying the phosphorus limits and the accompanying mixing zone because, in the unique circumstances presented by the Idaho Falls discharge, the limits will ensure compliance with Idaho Water Quality Standards as described in the American Falls TMDL, consistency with the treatment of Blackfoot, Shelly and Firth, and a mixing zone that is no larger than is needed. This mixing zone equates to a discharge load of 236 lbs/d annual average limit, 589 lbs/d Average Weekly Load (AWL) and 391 lbs/d Average Monthly Load (AML).

ANTIDEGRADATION

The Idaho water quality standards (WQS) provide that existing uses and the water quality necessary to protect the existing uses shall be maintained and protected (IDAPA 58.01.02.051.01). In addition, where water quality exceeds levels necessary to support uses, that quality shall be maintained and protected unless the Department finds, after intergovernmental coordination and public participation, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located (IDAPA 58.01.02.051.02).

The limits in the proposed new permit for the City are set at levels which ensure the state's numeric and narrative criteria will be met. The numeric and narrative criteria are set at levels which protect and maintain applicable designated and existing uses. Therefore, in accordance with IDAPA 58.01.02.051.01, the limits in the proposed new permit protect and maintain designated and existing uses in the Snake River.

Furthermore, the limits in the proposed new permit for the City are the same or more stringent than the limits in the existing permit. Phosphorus limits have been added to the permit for the first time. The new effluent limits for phosphorus will not lower water quality relative to the prior permit because the new limits require the facility's phosphorus load not be increased above current levels. In order to reflect a change to the WQS, the permit changes the bacteria limits from fecal coliform to *E. coli* limits. The *E. coli* limits, however, are as or more protective of water quality than the old fecal coliform limits. The limits in the proposed new permit, therefore, ensure that the existing level of water quality in the Snake River is maintained, and the analysis necessary to lower water quality set forth in IDAPA 58.01.02.051.02 is not triggered. Finally, new limits for ammonia based upon DEQ's current ammonia criteria will result in a lowering of water quality when compared to the discharge under the ammonia limits in the current permit. The degradation, however, has been determined to be insignificant, and therefore, no further tier 2 analysis is required. Idaho Code section 39-3603(2)(c).

The complete analysis is found in the accompanying two documents: DEQ's Antidegradation Review and the City of Idaho Falls Antidegradation Insignificance Determination.

COMPLIANCE SAMPLING LOCATIONS

DEQ authorizes the City to move compliance sampling locations from current locations to the two power plant spillways located at:

a) Above the influence of the facility's discharge, at: 43° 28' 5.8" N, 112° 3' 46.3" W.

b) Below the facility's discharge, at 43° 25' 17.4" N, 112° 6' 11.5" W

respectively.

OTHER CONDITIONS

The certification is conditioned upon the requirement that any material modification of this permit or the permitted activities including without limitation, any modifications of the permit to reflect new or modified TMDL waste load allocations or other new information, shall first be provided to DEQ for review to determine compliance with state Water Quality Standards and to provide additional certification pursuant to section 401.

RIGHT TO APPEAL FINAL CERTIFICATION

The final Section 401 Water Quality Certification may be appealed by submitting a petition to initiate a contested case, pursuant to Idaho Code § 39-107(5), and the Rules of Administrative Procedure Before the Board of Environmental Quality, IDAPA 58.01.23, within thirty-five (35) days of the date of the final certification.

Questions regarding the actions taken in this certification should be directed to Troy Saffle, DEQ (Idaho Falls Regional Office) at (208) 528-2650.

Erick Neher
Regional Administrator
DEQ Idaho Falls Regional Office

ANTIDEGRADATION REVIEW

NPDES Permit # ID-0021261 City of Idaho Falls Wastewater Treatment Facility

Idaho Department of Environmental Quality
August 6, 2012

Antidegradation Overview

In March 2011, Idaho incorporated new provisions addressing antidegradation implementation in the Idaho Code. The new antidegradation provisions are in Idaho Code § 39-3603. At the same time, Idaho adopted antidegradation implementation procedures in the Idaho Water Quality Standards ("WQS"). DEQ submitted the antidegradation implementation procedures to EPA for approval on April 15, 2011. On August 18, 2011 EPA approved of the implementation procedures.

The WQS contain an antidegradation policy providing three levels of protection to water bodies in Idaho (IDAPA 58.01.02.051). The first level of protection applies to all water bodies subject to Clean Water Act jurisdiction and assures that existing uses of a water body and the level of water quality necessary to protect the existing uses will be maintained and protected (Tier 1 protection) (IDAPA 58.01.02.051.01; 58.01.02.052.01). A Tier 1 review is performed for all new or reissued permits or licenses (IDAPA 58.01.02.052.05). The second level of protection applies to those water bodies that are considered high quality and assures that no lowering of water quality will be allowed unless it is deemed necessary to accommodate important economic or social development (Tier 2 protection) (IDAPA 58.01.02.051.02; 58.01.02.052.06). The third level of protection applies to water bodies that have been designated outstanding resource waters and requires activities to not cause a lowering of water quality (Tier 3 protection) (IDAPA 58.01.02.03; 58.01.02.052.07).

DEQ is employing a waterbody-by-waterbody approach to implementing Idaho's antidegradation policy. This approach to antidegradation implementation means that any water body fully supporting its beneficial uses will be considered high quality (Idaho Code §39-3603(2)(b)(i)). Any water body not fully supporting its beneficial uses will be provided Tier 1 protection for that use, unless specific circumstances warranting Tier 2 protection are met (Idaho Code §39-3603(2)(b)(iii)). The most recent federally-approved Integrated Report and supporting data are used to determine support status and the tier of protection (Idaho Code §39-3603(2)(b)).

Pollutants of Concern

The City of Idaho Falls Wastewater Treatment Facility (Idaho Falls) discharges the following pollutants of concern: biological oxygen demand (BOD), total suspended solids (TSS), *E. coli*, pH, chlorine, ammonia, phosphorus, nitrate, zinc, chromium, copper, lead, silver, chloroform, dichlorobromomethane, toluene, and whole effluent toxicity. Effluent limitations have been developed for BOD, TSS, *E. coli*, pH, chlorine, ammonia, and phosphorus. Effluent limitations were not deemed necessary for nitrate, zinc, chromium, copper, lead, silver, chloroform, dichlorobromomethane, toluene, or WET. Monitoring will be conducted during the permit cycle

for arsenic, cadmium, chromium VI, total chromium, copper, cyanide, lead, mercury, nickel, orthophosphate, silver, and zinc for further analysis during the next permit renewal.

Receiving Water Body Level of Protection

Idaho Falls discharges to the Snake River (assessment unit ID17040201SK001_04). This Snake River assessment unit (AU) has the following designated beneficial uses: cold water aquatic life; salmonid spawning; primary contact recreation; aesthetics; wildlife habitats; and domestic, agricultural, and industrial water supply. There is no other information indicating the presence of existing beneficial uses other than those that are designated.

Idaho has established a water body-by-water body approach for identifying what level of antidegradation protection DEQ will provide when reviewing whether activities or discharges will comply with Idaho's antidegradation policy. This approach relies upon Idaho's most recent federally-approved Integrated Report (IR) of water quality status and its supporting data.

According to the final 2010 Integrated Report (DEQ 2010), the cold water aquatic life and recreation uses in this Snake River AU have not been assessed. As such, DEQ will determine the appropriate level of antidegradation protection on a site-specific basis using available information (Idaho Code §39-3603(2)(b)). As part of a random design for assessing the condition of Idaho's rivers, DEQ performed river assessment protocols at a location approximately 10 miles downstream from the Idaho Falls discharge. DEQ collected macroinvertebrate and fish samples at site ID 2006DEQA081. The macroinvertebrate data was sufficient to calculate the river macroinvertebrate index, which indicated the community was healthy. However, not enough fish were collected to calculate the river fish index. According to Dan Garren, Regional Fisheries Manager for the Idaho Department of Fish and Game (personal communication, 5/16/11) this section of the Snake River is managed as a trophy fishery for sturgeon and brown trout. None of the water quality data collected at USGS gage 13057155 indicates violations of water quality criteria. Given this information, DEQ will provide Tier 2 antidegradation protection to cold water aquatic life. Because e. coli samples indicate full support of the recreation use criteria, Primary Recreation use will also be afforded Tier 2 protection.

Protection and Maintenance of Existing Uses

In order to protect and maintain designated and existing beneficial uses, a permitted discharge must comply with Idaho water quality standards (WQS), which contain narrative and numeric criteria as well as other provisions of the WQS such as Section 054 which addresses water quality limited waters. The numeric and narrative criteria are set at levels which ensure protection of existing and designated beneficial uses. The effluent limitations and associated requirements contained in the permit are set at levels that ensure compliance with the narrative and numeric criteria in the WQS. Because there is no available information indicating the presence of any existing uses other than the designated uses discussed above, the permit ensures that the level of water quality necessary to protect both designated and existing uses is maintained and protected, in compliance with IDAPA 58.01.02.051.01, IDAPA 58.01.02.052.05, and 40 CFR § 131.12(a)(1).

Water bodies not supporting existing or designated beneficial uses must be identified as water quality limited, and a total maximum daily load (TMDL) must be prepared for any water quality limited water body. A central purpose of TMDLs is to establish wasteload allocations for point source discharges, which are set at levels designed to help restore the water body to a condition that supports existing and designated beneficial uses. Discharge permits must contain limitations that comply with the approved TMDL.

The final American Falls Subbasin Assessment and TMDL (DEQ, July 2009) has not yet been approved by EPA because it is currently under review by the Shoshone-Bannock tribes. The American Falls Reservoir is 45 miles downstream from the Idaho Falls discharge. Although the Snake River itself is not showing impairment due to nutrient enrichment, it is a significant contributor of nutrients to the American Falls Reservoir. As such, the TMDL established a load allocation for the Snake River at Ferry Butte (Tilden Bridge) that is representative of current loads. In order to have reasonable assurance the load allocation at this location will be met, the total phosphorus discharged from Idaho Falls must be limited. The limits developed for Idaho Falls must be representative of their current discharge. In response to comments, DEQ has re-evaluated the draft TP effluent limitations. DEQ has determined that the draft TP effluent limitations should be revised and has included a condition in its final water quality certification. These revised limitations for TP are set at levels that will ensure assumptions made in the TMDL modeling effort will not be violated and the beneficial uses in the Snake River and the American Falls Reservoir will be protected.

The effluent limitations and associated conditions contained in the Idaho Falls permit and the 401 water quality certification are set at levels that ensure compliance with the narrative and numeric criteria as well as the American Falls TMDL. Therefore, DEQ has determined the permit will protect and maintain existing and designated beneficial uses in the Snake River.

High Quality Waters

As indicated previously, Idaho Falls discharges to a segment of the Snake River that is considered high quality for cold water aquatic life and recreation. As such, the quality of the Snake River must be maintained and protected for these uses, unless a lowering of water quality is deemed necessary to accommodate important social or economic development.

To determine whether degradation will occur, DEQ must evaluate how the permit issuance will affect water quality for each pollutant that is relevant to cold water aquatic life and recreation uses of the Snake River. (IDAPA 58.01.02.052.04). These include the following pollutants: BOD, TSS, *E. coli*, pH, chlorine, ammonia, phosphorus, nitrate, zinc, chromium, copper, lead, silver, chloroform, dichlorobromomethane, toluene, and whole effluent toxicity. Effluent limits are set in the proposed and existing permit for BOD, TSS, *E. coli*, pH, chlorine, and ammonia. New limits for phosphorus are in the proposed permit. Fecal coliform limits are in the current permit but were removed from the proposed permit. No limits are proposed in either the current or proposed permit for the following pollutants: nitrate, zinc, chromium, copper, lead, silver, chloroform, dichlorobromomethane, toluene, and WET,

For a reissued permit or license, the effect on water quality is determined by looking at the difference in water quality that would result from the activity or discharge as authorized in the current permit and the water quality that would result from the activity or discharge as proposed in the reissued permit or license (IDAPA 58.01.02.052.04.a).

Pollutants with Limits in the Current and Proposed Permit

For pollutants that are currently limited and will have limits under the reissued permit, the current discharge quality is based on the limits in the current permit or license (IDAPA 58.01.02.052.04.a.i), and the future discharge quality is based on the proposed permit limits (IDAPA 58.01.02.052.04.a.ii). Table 1 provides a summary of the existing permit limits and the proposed reissued permit limits.

Table 1. Comparison of proposed permit limits with current permit limits for those parameters which this Snake River assessment unit is considered high quality.

		Proposed Permit			**Current Permit**		
Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
Five-Day BOD	mg/L	30	45	-	30	45	-
	lb/day	4250	6380	-	4250	6380	-
	% removal	85%	-	-	85%	-	-
TSS	mg/L	30	45	-	30	45	-
	lb/day	4250	6380	-	4250	6380	-
	% removal	85%	-	-	85%	-	-
pH	s.u.	6.5 – 9.0 all times			6.5 – 9.0 all times		
Fecal coliform	#/100 mL	-	-	-		200	
E. coli	#/100 mL	126		406	126		406
Total Residual Chlorine	µg/L	54	-	95	90	-	200
	lb/day	7.6	-	13.5	-	-	-
Total Ammonia (Jun – Sep)	mg/L	3.8	-	14.1	1.1	-	3.3
	lb/day	539	-	1999	160	-	470
Total Ammonia (Oct – May)	mg/L	3.4	-	12.3	1.8	-	5.7
	lb/day	482	-	1744	260	-	810
Total Phosphorus	mg/L	Report	Report	-	-	-	-
	lb/day	391	586	-	-	-	-
	ld/day	Annual Average Limit: 236 lb/day			-	-	-

The proposed permit limits in Table 1 are the same as, or more stringent than those in the current permit, except ammonia.

The existing permit for Idaho Falls contains effluent limitations for fecal coliform as well as *E. coli*. The *E. coli* limits were in the permit to reflect the bacteria criterion that DEQ adopted to protect the contact recreation beneficial use (IDAPA 58.01.02.251.01). The fecal coliform limit was in the current permit because at the time the permit was issued, IDAPA 58.01.02.420.05 established a disinfection requirement for sewage wastewater treatment plant effluent. This requirement specified fecal coliform concentrations not exceed a geometric mean of 200/100 mL fecal coliform based on a minimum of five samples in one week. This section of Idaho WQS was revised in 2002 to reflect an earlier change in the bacteria criterion from fecal coliform to *E. coli*. As such, the proposed reissuance permit for Idaho Falls removes the fecal coliform limits. The *E. coli* limits are as or more protective of water quality than the old fecal coliform limits. In 1986, EPA updated its criteria to protect recreational use of water recommending an *E. coli* criterion as a better indicator of bacteria levels that may cause gastro-intestinal distress in swimmers than fecal coliform. DEQ changed its bacteria criterion from fecal coliform to *E. coli*, which as indicated earlier, is reflected in the current permit for Idaho Falls. The proposed permit contains *E. coli* effluent limitations that comply with numeric criteria at the "end-of-pipe." Therefore, the removal of the fecal coliform limit will not cause a lowering of water quality.

The ammonia limit in the proposed permit is less stringent than the limit in the current permit. The new limit is less stringent because it is based upon new criteria that are less stringent than the criteria used to set the limit in the current permit. The new less stringent ammonia limits will result in water quality degradation with respect to ammonia. If, however, the degradation is determined to be insignificant, then no further tier 2 analysis is required. Idaho Code section 39-3603(2)(c). DEQ shall determine degradation is insignificant when the proposed change in the water quality from conditions as of July 1, 2011, will not cumulatively decrease assimilative capacity by more than ten percent (10%). Idaho Code section 39-3603(2)(c)(i). As shown in the attached insignificance analysis, the degradation as a result of the less stringent ammonia limits will not decrease assimilative capacity for ammonia in the Snake River by more than ten percent. Therefore, the degradation is insignificant, and no additional tier 2 analysis for ammonia is required.

<u>New Permit Limits for Pollutants Currently Discharged</u>

When new limits are proposed in a reissued permit for pollutants in the existing discharge, the effect on water quality is based upon the current discharge quality and the proposed discharge quality resulting from the new limits. Current discharge quality for pollutants that are not currently limited is based upon available discharge quality data (IDAPA 58.01.02.052.04.a.i). Future discharge quality is based upon proposed permit limits (IDAPA 58.01.02.052.04.a.ii).

The effluent limit for total phosphorus in the proposed permit is a new limit which is not included in the current permit. Because this new limit maintains the current load of phosphorus in the discharge, it does not result in a lowering of water quality.

<u>Pollutants with No Limits</u>

There are a number of pollutants of concern relevant to Tier 2 protection of aquatic life that currently are not limited and for which the proposed permit also contains no limits (Table 1). For such pollutants, a change in water quality is determined by reviewing whether there will likely be changes in production, treatment or operation that will increase the discharge of these pollutants (IDAPA 58.01.02.052.04.a.ii).

With respect to those pollutants in the discharge for which there are no limits in the proposed permit, and no limits in the current permit, there is no reason to believe that these pollutants will be discharged in quantities greater than that which is allowed to be discharged under the current permit. Similarly, there is no reason to believe the effluent contains new pollutants that haven't been discharged previously. These conclusions are based upon the fact that there has been no change in the design flow, influent quality or treatment processes that would likely result in new or increased discharge of pollutants. Because the proposed permit does not allow for a new or increased water quality impact, DEQ has concluded that the proposed permit will not cause a lowering of water quality for the pollutants with no limits. As such, the proposed permit will maintain the existing high water quality in the Snake River for these pollutants.

Ammonia Antidegradation Review for the City of Idaho Falls WWTF

PREPARED FOR: City of Idaho Falls

PREPARED BY: Tom Dupuis/CH2M HILL
Brian Drake/CH2M HILL

COPIES: Rick Bishop/CH2M HILL

DATE: December 19, 2011

Background

NPDES Permit History

The City of Idaho Falls' (City) wastewater treatment facility (WWTF) has a National Pollutant Discharge Elimination System (NPDES) permit to discharge treated wastewater to the Snake River. The current effective permit (Current Permit) was issued by U.S. Environmental Protection Agency Region 10 (EPA Region 10) in April 2001. The Current Permit included water quality-based effluent limits (WQBELs) for ammonia. Previous permits did not include WQBELs for ammonia. These WQBELs were derived from the ambient water quality criteria in Idaho's Water Quality Standards in effect at that time. These ammonia criteria were, in turn, based on national criteria published by U.S. EPA in 1984 (EPA 1984). U.S. EPA had published more recent criteria in 1999 (EPA 1999). In December 2000, the City provided timely comments on the public comment draft version of the Current Permit. One of these comments was that ammonia limits should be based on the more recent scientifically-derived U.S. EPA criteria from 1999.

The Idaho Department of Environmental Quality (DEQ) issued its water quality certification of the Current Permit in April 2001 and noted in that letter that it supported modification of the permit if DEQ modifies its criteria to adopt the 1999 U.S. EPA criteria. EPA Region 10, in its response to comments on the draft permit noted: "Should the State revise the ammonia criteria, and those criteria are subsequently approved by EPA, the City could then petition EPA at that time to modify the permit based on new criteria." The final version of the Current Permit contained a schedule of compliance (SOC) that required the City to submit annual reports of progress and to be in compliance with the WQBELs by May of 2006. The Current Permit also expired in May of 2006 and has been administratively extended since that time.

DEQ did, in fact, adopt the 1999 criteria, which became effective in March 2002, and EPA Region 10 subsequently approved these criteria in November of 2002. In March 2003 the City sent a letter of petition to EPA Region 10 to modify the WQBELs for ammonia using the EPA-approved revised criteria. The City reiterated this request in January and May of 2004. On June 21, 2004 EPA Region 10 provided written correspondence to the City which confirmed EPA Region 10 authority to modify the permit based on revised criteria, but noted that due to workload considerations and limited resources, EPA was not able to modify the permit at that time as requested. The letter further stated that EPA Region 10 would schedule permit reissuance in 2006 and re-evaluate the WQBELs for ammonia at that time. The City has made a number of additional inquiries and requests for modification or timely reissuance to revise the WQBELs consistent with the revised criteria.

EPA Region 10 public-noticed a draft NPDES permit in October 2010 (Reissuance Permit). The Reissuance Permit retained the WQBELs for ammonia from the Current Permit. The Fact Sheet for the permit noted that these WQBELs were retained because of anitbacksliding considerations. One of the City's timely comments on the draft Reissuance Permit stated that the WQBELs could and should be revised because one of the exceptions to antibacksliding clearly pertains to the Idaho Falls discharge. This is the exception under Clean Water Act (CWA) sections 402(o)(1) and 303(d)(4)(B) pertaining to attainment waters. This exception allows less stringent WQBELs for waters that are not impaired as long as the revised limits are consistent with the State's antidegradation regulations.

EPA Region 10 has not yet issued the final version of the Reissuance Permit.

Idaho Falls Wastewater Planning and Treatment Upgrade

In 2008 the City initiated a wastewater facilities planning process to address ammonia treatment and other facilities needs. In August of 2010 DEQ approved the facilities plan and in February 2011 the City received judicial confirmation for an Ordinary and Necessary determination to accept a State Revolving Fund loan to upgrade the wastewater plant, including further ammonia treatment, at an anticipated cost of about $18 million. The City is now in the process of engineering design for this upgrade and anticipates it to be fully operational by October 2015. Also note that as of November 2011, the City of Ammon will no longer send wastewater to the City for treatment, reducing the City of Idaho Falls raw wastewater flows by about 1 million gallons per day (mgd).

DEQ Antidegradation Regulations

State statute 39-3603 and State rules (IDAPA 58.01.02.051) have defined DEQ antidegradation requirements for a number of years. In September 2009, however, the Idaho Conservation League (ICL) filed notice of intent of litigation against U.S. EPA and Region 10, and filed the actual lawsuit in April 2010. This litigation sought to require more detailed regulations for implementation of the antidegradation policy. DEQ undertook an extensive negotiated rule-making process in April 2010 and a final rule, as modified by the State Legislature, was submitted to EPA Region 10 for approval in April 2011. EPA Region 10 approved the rule in August 2011.

DEQ also initiated an extensive public stakeholder process to develop a guidance document to further clarify how the antidegradation rules would be implemented. The most recent draft of this guidance publically available was posted on the DEQ website in August 3, 2011. It is that version of the guidance, plus the revised version of Appendix F (Decision Tree for Baseline Water Quality, as revised at the August 5th stakeholder meeting) referenced in this Technical Memorandum.

CH2M HILL participated in the rule-making and guidance meetings on behalf of the City.

Purpose of this Technical Memorandum

DEQ has notified the City that it may be possible to modify the WQBELs for ammonia in the yet to be finalized Reissuance Permit. This would require that it be demonstrated that the revised limits would be consistent with the State's new antidegradation rules. DEQ has confirmed that the Snake River near Idaho Falls is a high quality water (i.e., not impaired) for ammonia, which would allow for that exception to antibacksliding to be applied in the Reissuance Permit. The City has agreed to provide supporting technical analyses to demonstrate that revised limits the City would propose will be consistent with antidegradation requirements and hence authorize the CWA exception to antibacksliding. This technical memorandum describes the antidegradation calculations that CH2M HILL performed for the City. There is an accompanying Microsoft Excel workbook that provides the underlying data and calculations described in the memorandum ("IdahoFalls_Antidegradation_10_19_2011.xlsx"). This file has also been provided to DEQ.

Focus of This Antidegradation Evaluation

In August 2011, DEQ issued their draft *Idaho Antidegradation Implementation Procedure*. This document provides guidance for conducting reviews of permits to determine compliance with the antidegradation provisions in Idaho's water quality standards. CH2M HILL focused on the following key components during our review:

- Insignificant Degradation – Per Idaho Administrative Procedures Act (IDAPA) 58.01.02.052.08.a, no further Tier II analysis shall be required when the proposed change in discharge will not cumulatively decrease assimilative capacity by more than 10 percent.
- Baseline Condition – The assimilative capacity analysis described above will assess the baseline river condition as of July 1, 2011 (consistent with the antidegradation rule). Baseline condition assumes that all upstream sources of pollutants (i.e., other WWTFs) are discharging at their permitted limits.

DEQ's antidegradation rule and guidance affirm that if the revised WQBELs result in insignificant degradation, then no further antidegradation analyses are needed (e.g., alternatives analyses and socioeconomic justifications are not needed). According to the analyses described herein, the revised WQBELs proposed in this memorandum would result in insignificant degradation.

Technical Analyses

This section describes the technical analyses that were conducted to establish the baseline condition for ammonia and demonstrate that insignificant degradation would occur with revised, higher ammonia permit limits.

Baseline Condition

The baseline condition under consideration is the concentration of ammonia just downstream of the WWTF following complete mixing of the river and the WWTF effluent.

Upstream River Ammonia. The City collects ambient Snake River water quality data upstream and downstream of the WWTF on a regular basis (approximately monthly or quarterly depending on the year and or time of year), and we compiled upstream total ammonia nitrogen (ammonia), temperature, and pH data back to 2001. 2001 to 2011 represents the entire dataset over the past decade, but may not be completely representative of current WWTF operating conditions (WWTF data are used in subsequent analyses). 2009 to 2011 represents the past three years, but data was only collected on a quarterly basis. Finally, the 2006 to 2011 dataset is thought to be representative of current WWTF operating conditions and includes greater than 30 observations, satisfying DEQ guidance. Thus, we selected the 2006-2011 dataset for the antidegradation analyses.

EPA Region 10 uses the 95th percentile as a conservative characterization of ambient concentrations when evaluating permit limits. DEQ's antidegradation guidance generally recommends at least 30 measurements across the full range of expected variation to define that value, although as few as 12 measurements may be acceptable (DEQ, 2010). After reviewing the dataset, the 2006 to 2011 subset was selected because it satisfies the 30 observations suggested in DEQ guidance for defining the 95th percentile, is representative of current WWTF operating conditions (WWTF data are used in subsequent analyses), and is aligned with the available period of record of dissolved oxygen (DO) data used in later analyses. Exhibit 1 presents 95th percentile statistics for ammonia, temperature, and pH in the Snake River upstream of the WWTF for the 2006 to 2011 dataset.

EXHIBIT 1
Upstream River Water Quality – 95th Percentile
Snake River Water Quality Just Upstream of the Idaho Falls WWTF

	Ammonia, 95th Percentile (mg/L)		**Temperature, 95th Percentile** (°C)		**pH, 95th Percentile** (standard units)	
Period of Record	**June – Sept**	**October - May**	**June – Sept**	**October - May**	**June – Sept**	**October - May**
2006 – 2011	0.25	0.41	18.0	11.0	8.35	8.50

WWTF Ammonia. Since the Idaho Falls WWTF was discharging as of July 1, 2011 (consistent with the baseline in the rule), its permitted load is factored into the baseline condition. Exhibit 2 presents the WWTFs average monthly limit (AML) and maximum daily limit (MDL) for ammonia discharge in the Current Permit.

EXHIBIT 2
Idaho Falls WWTF Ammonia Limits
WWTF Effluent Ammonia Under the Current Permit

	AML		**MDL**	
Constituent	**June – Sept**	**October - May**	**June – Sept**	**October - May**
Ammonia (mg/L)	1.1	1.8	3.3	5.7

River Flow. WQBELs are determined based on critical low river flows. For ammonia, the chronic criterion uses a biologically-based flow rate designed to ensure an excursion frequency of no more than once every three years for a 30-day average flow rate (30B3). The acute criterion uses the lowest one-day average flow rate expected to occur once every ten years (1Q10). Per the recent Idaho Falls draft Reissuance Permit Fact Sheet (EPA, 2010), the 1Q10 and 30B3 flows are 1,170 and 1,840 cfs, respectively. These flows are based on annual data.

For this review, the critical 1Q10 and 30B3 flows were updated based on the most recent available data. According to the Fact Sheet (EPA, 2010) Snake River flows at the WWTF represent the sum of flows measured in the Snake River

above Eagle Rock near Idaho Falls (USGS Station 13057155) and the Great Western Spillback (USGS Station 13057132). Data from October 1987 to September 2011 were downloaded and screened to remove any missing or provisional data. The DFLOW software package (EPA, 2011) was used to calculate the 1Q10 and 30B3 flows using the current data. Since ammonia limits are permitted on a seasonal basis (June to September and October to May), flows were calculated both on an annual basis (following the methodology used in the Current and draft Reissuance Permits) and on a seasonal basis. Exhibit 3 presents the results of those flow analyses. Summer season design flows are higher than winter because of the way the Snake River flows are managed for irrigation purposes.

EXHIBIT 3
Revised Snake River Flows
Critical Flows at the Idaho Falls WWTF Determined using DFLOW

Flow Type	Draft Reissuance Permit Annual Basis	Revised Annual Basis	Seasonal Basis	
			June – Sept	October - May
1Q10 (cfs)	1,170	1,160	2,490	1,060
30B3 (cfs)	1,840	1,760	3,970	1,670

Mixed Downstream Ammonia. Assuming fully mixed conditions, consistent with the DEQ guidance, a mass balance of the river ammonia concentrations reported in Exhibit 1 (using the revised river flows reported in Exhibit 3) and the permitted WWTF ammonia discharge limits reported in Exhibit 2 (using the permitted flow of 17 mgd) yields mixed downstream ammonia concentrations. Those mixed downstream ammonia concentrations, which serve as the baseline condition for subsequent assimilative capacity analyses, are reported in Exhibit 4. As described in the Background section earlier in this memorandum, the City has been anticipating revised WQBELs for ammonia for a number of years, and thus the WQBELs in Exhibit 4 have not been achieved, although the City is moving forward with treatment upgrades including further ammonia removal. The DEQ guidance is clear that the basis for antidegradation evaluation is comparison of current permit limits to those proposed for the new or revised permit (not actual discharge levels).

EXHIBIT 4
Mixed Downstream Ammonia Concentrations
Ammonia Concentrations in the Snake River following Mixing with WWTF Effluent

	Ammonia (mg/L)			
	River Mixed with AML		River Mixed with MDL	
Low Flow Basis	June – Sept	October - May	June – Sept	October - May
Annual	0.26	0.43	0.34	0.53
Seasonal	0.25	0.43	0.30	0.54

Other Considerations. The *Idaho Antidegradation Implementation Procedure* (DEQ, 2011) insists that the baseline condition must give consideration to upstream WWTFs discharging at their permitted limits even if they currently discharge at some lesser level. Permitted municipal dischargers upstream of Idaho Falls include the Rexburg WWTF and the St. Anthony WWTF. To determine if those facilities discharging at their full permit limits would result in a substantial ammonia load at Idaho Falls, we constructed a simple mass balance model that would account for dilution and ammonia decay during transport.

Since 30B3 flows were not available at upstream flow input locations, nine separate basins were delineated using the StreamStats (USGS, 2011) program, and an area-weighted flow was determined for each basin based on the revised flows at Idaho Falls. Exhibit 5 identifies the delineated basins and the area-weighted flow for each basin.

EXHIBIT 5
StreamStats Delineation and Area-Weighted 30B3 Flows
Flows Used in the Mass Balance Model

Basin	Area (mi^2)	Area-Weighted 30B3 Flow, Annual Basis (cfs)	Area-Weighted 30B3 Flow, Seasonal Basis (cfs)	
			June – Sept	October - May
Henrys Fork above St. Anthony[1]	1,844	566	1,277	372
Henrys Fork above Teton	1,946	597	1,347	392
Teton	922	283	638	186
Henrys Fork above South Fork Teton	3,050	936	2,112	615
South Fork Teton	192	59	133	39
South Fork Teton above Rexburg	180	55	125	36
Henrys Fork above South Fork Snake	3,334	1,023	2,308	672
South Fork Snake	1,862	572	1,289	375
Snake above Idaho Falls	5,734	1,760	3,970	1,670

Notes:
[1] – The St. Anthony WWTF NPDES Permit Fact Sheet (EPA, 2009) lists 30B3 flows of 698 (annual basis), 684 (June-October), and 985 (November-May) cfs. However, since defined 30B3 flows were not available elsewhere in the system and the area-weighted flow is smaller (more conservative from a dilution perspective), the area-weighted flows were used throughout the analysis.

In addition to dilution, ammonia was assumed to degrade via first order decay using the following equation:

$$NH_{3f} = NH_{3i}e^{-kt}$$

Where: NH_{3i} = initial ammonia concentration (mg/L)
NH_{3f} = final ammonia concentration (mg/L)
t = travel time ($days^{-1}$)
k = first-order decay constant = $1.047^{(T-20)}$ (Chapra, 1997)
Where: T = temperature = 15 °C (assumed)

In the model we constructed, nodes were assigned to each significant input (WWTF or tributary). At each node, upstream flow was assumed to completely mix with the nodal input. The travel time to the next node was then taken into account (assuming an average velocity of 2 feet per second) to determine the amount of decay expected to occur in that segment. After calculating the resulting ammonia concentration, that concentration became the upstream input for the next node and the process was repeated. Exhibit 6 presents a rough schematic of the nodal network.

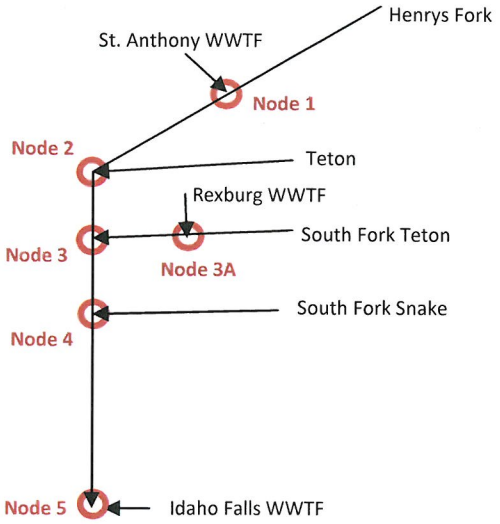

EXHIBIT 6
NODAL NETWORK USED TO EXAMINE UPSTREAM AMMONIA

For this analysis, the ammonia was only contributed to the network by the WWTFs; tributaries were assumed to have none. This assumption is valid because the purpose of the analysis is to determine if substantial ammonia from the upstream WWTFs would reach Idaho Falls if they were discharging at their permitted limits. Exhibit 7 presents the resultant ammonia concentrations at each node.

EXHIBIT 7
Ammonia Concentrations Upstream of Idaho Falls
Estimated Ammonia Concentrations Near Nodal Inputs Following Dilution and Decay

	Ammonia (mg/L)			
	Annual Flow Basis		**Seasonal Flow Basis**	
Node	**June – Sept**	**October - May**	**June – Sept**	**October - May**
Upstream of 1	0.00	0.00	0.00	0.00
Downstream of 1	0.06	0.06	0.03	0.09
Upstream of 2	0.04	0.04	0.02	0.06
Downstream of 2	0.03	0.03	0.01	0.04
Upstream of 3 (Henrys Fork)	0.02	0.02	0.01	0.03
Upstream of 3A	0.00	0.00	0.00	0.00
Downstream of 3A	0.17	0.18	0.08	0.27
Upstream of 3 (South Fork Teton)	0.14	0.15	0.07	0.21
Downstream of 3	0.03	0.03	0.01	0.04
Upstream of 4	0.02	0.02	0.01	0.03
Downstream of 4	0.01	0.01	0.01	0.02
Upstream of 5	0.005	0.005	0.002	0.008

As demonstrated in Exhibit 7, even at fully permitted limits, ammonia contributed by the St. Anthony and Rexburg WWTFs is present in negligible concentrations by the time it reaches Idaho Falls. Consequently, the baseline

condition for ammonia established earlier in the previous section would not change if the upstream WWTFs were to discharge at their permitted limits.

Insignificant Degradation

Now that we have established the baseline ambient condition for ammonia in the Snake River at Idaho Falls (Exhibit 4), it is necessary to demonstrate that higher ammonia discharge limits would not decrease the river's assimilative capacity by more than 10 percent. Assimilative capacity is defined as the difference between ambient concentration and the concentration allowed by the controlling criterion (DEQ, 2011).

Ammonia Criteria. Per the Idaho water quality standards (IDAPA, 2011), which are based on EPA's 1999 guidelines (EPA, 1999), freshwater ammonia limits are temperature and pH dependent. The acute criterion, which is equivalent to the criterion maximum concentration (CMC), is the one hour average concentration of total ammonia nitrogen not to be exceeded more than once every three years. The chronic criterion, which is equivalent to the criterion continuous concentration (CCC), is the thirty day average concentration of total ammonia nitrogen not to be exceeded more than once every three years. The Idaho criteria, when fish early life stages are present, are presented in the equations below.

$$Acute\ Criterion, CMC = \frac{0.275}{1 + 10^{7.204-pH}} + \frac{39.0}{1 + 10^{pH-7.204}}$$

$$Chronic\ Criterion, CCC = \left(\frac{0.0577}{1 + 10^{7.688-pH}} + \frac{2.487}{1 + 10^{pH-7.688}}\right) \times MIN\left(2.85, 10^{0.028-(25-T)}\right)$$

Using the equations above, and the river temperature and pH data from Exhibit 1, ammonia criteria were calculated and are reported in Exhibit 8.

EXHIBIT 8
Ammonia Criteria for the Snake River
Acute and Chronic Criteria

	Ammonia (mg/L)	
Criterion	**June – Sept**	**October - May**
Acute, CMC	2.89	2.16
Chronic, CCC	1.13	1.10

Assimilative Capacity. As defined earlier, assimilative capacity is the difference between ambient concentration and the concentration allowed by the controlling criterion. Using the baseline condition established in Exhibit 4 and the criteria established in Exhibit 8. Exhibit 9 presents the difference, or assimilative capacity, on both an annual flow and seasonal flow basis.

EXHIBIT 9
Assimilative Capacity at Idaho Falls

	Ammonia (mg/L)			
	Based on Chronic Criterion		**Based on Acute Criterion**	
Low Flow Basis	**June – Sept**	**October - May**	**June – Sept**	**October - May**
Annual	0.87	0.67	2.55	1.63
Seasonal	0.88	0.67	2.58	1.62

Using the assimilative capacity values from Exhibit 9, we recalculated the preliminary ammonia effluent limits that would restrict the assimilative capacity decrease to less than 10 percent, and those results are presented in Exhibit 10.

EXHIBIT 10
Revised Preliminary Ammonia Effluent Limits

		Ammonia			
		Preliminary AML, Based on Chronic Criterion		Preliminary MDL, Based on Acute Criterion	
Low Flow Basis	Parameter	June – Sept	October - May	June – Sept	October - May
Annual	Revised Limit (mg/L)	6.9	6.3	14.7	13.0
	Used Capacity	9.8%	9.9%	9.9%	9.9%
Seasonal	Revised Limit (mg/L)	14.3	6.0	27.8	12.3
	Used Capacity	9.9%	9.7%	9.9%	9.8%

The Controlling Criterion and Corresponding Limits. The preliminary revised AMLs and MDLs presented in Exhibit 10 are based on the chronic criterion for the AMLs and the acute criterion for the MDLs. However, technical guidance suggests that both the AML and MDL need to be based on the same, more restrictive criterion and appropriately translated to the other limit. Using the statistical transformation procedure outlined in the *Technical Support Document for Water Quality-Based Toxics Control* (EPA, 1991), the preliminary AMLs from Exhibit 10 were translated into equivalent MDLs and vice versa using the following equation.

$$\frac{MDL}{AML} = \frac{exp(z_m\sigma - 0.5\sigma^2)}{exp(z_a\sigma_n - 0.5\sigma_n^2)}$$

Where: z_m =2.326 = percentile exceedance probability for MDL (99th percentile basis)
z_a = 1.645 = percentile exceedance probability for AML (95th percentile basis)
n = 30 = samples per month
CV = 1.02 (June – September) = coefficient of variation for 2006 to 2011 effluent dataset
= 0.97 (October – May)
$\sigma^2 = \ln(CV^2 + 1)$
$\sigma_n^2 = \ln(CV^2/n + 1)$

The results of those translations are presented in Exhibit 11.

EXHIBIT 11
Revised Ammonia Effluent Limits Based on the Controlling Criterion

		Ammonia (mg/L)			
		Based on Chronic Criterion		Based on Acute Criterion	
Low Flow Basis	Parameter	June – Sept	October - May	June – Sept	October - May
Annual	AML	6.8	6.3	3.9	3.6
	MDL	25.5	22.8	14.7	13.0
Seasonal	AML	13.9	6.0	**7.4**	**3.4**
	MDL	52.2	21.7	**27.8**	**12.3**

The results from Exhibit 11 suggest that the acute criterion is controlling, and that the scenario using annual low flows is generally more conservative than using seasonal flows. However, using seasonal river flows is more representative of river flow management for irrigation purposes. This seasonal scenario, presented in bold in Exhibit 11, provides proposed new WQBELs that are higher than Current Permit WQBELs and still meet DEQ's antidegradation rule and guidance.

Dissolved Oxygen. In natural waterbodies, ammonia undergoes nitrification, which consumes oxygen. Since the proposed ammonia limits identified in Exhibit 11 are comparable to or lower than current ammonia discharges (see Exhibit 12), the potential for additional oxygen to be consumed is minimal. Exhibit 12 summarizes the 2006 to 2011 dataset for effluent ammonia.

EXHIBIT 12
Idaho Falls WWTF Effluent Ammonia Summary
2006 - 2011

	Ammonia (mg/L)	
Statistic	**June – Sept**	**October - May**
Average	1.7	6.0
95th Percentile	4.4	16.2
Maximum	15.1	56.7

Even though ammonia discharge from the WWTF will not be increased relative to the actual current loads, it is worth examining if a dissolved oxygen problem currently exists. Exhibit 13 presents dissolved oxygen data collected in the vicinity and further downstream of the WWTF.

EXHIBIT 13
Snake River Dissolved Oxygen in Vicinity of the Idaho Falls WWTF
2006 - 2011

		Dissolved Oxygen (mg/L)			
Location	**Distance from WWTF**	**Average**	**5th Percentile**	**Minimum**	**Criteria**
Upstream of WWTF	Negligible	9.5	8.0	7.9	6.0
Downstream of WWTF	Negligible	9.4	8.0	7.9	6.0
Shelley (USGS Gage 13060000)	6 miles downstream	10.3	8.2	7.6	6.0

As demonstrated in Exhibit 13, there is negligible difference in DO immediately upstream and downstream of the WWTF. And, DO concentrations 6 miles downstream at Shelley (where you might expect DO consumption via nitrification to have taken effect) are actually higher than just downstream of the WWTF. Based on those data, and considering that the WWTF regularly discharges ammonia concentrations similar to or greater than the new proposed limits (and the fact that the City of Ammon wastewater will no longer be treated by the City), the river would not be adversely affected by the proposed revised WQBELs for ammonia from a DO standpoint.

Conclusions

As documented earlier in this memo, the DEQ's new antidegradation guidance provides an avenue to potentially increase ammonia discharge limits for the Idaho Falls WWTF. With these analyses, CH2M HILL reached the following key conclusions.

- Ammonia contributions from upstream WWTFs (Rexburg and St. Anthony) have a negligible impact on the baseline condition for ammonia in the river at Idaho Falls.
- By establishing the river's assimilative capacity, limiting a potential decrease in that capacity to less than 10 percent, and statistically transforming limits based on the controlling criterion, we recommend the following ammonia discharge limits as presented in Exhibit 14 (which highlight the key results from Exhibit 11). The limits recommended are based on seasonal river flow statistics to realistically reflect seasonal river flow management for irrigation.

EXHIBIT 14
Proposed Ammonia Limits for the Idaho Falls WWTF
Based on the Acute Criterion and Seasonal Low Flow Basis

	Ammonia (mg/L)	
Criterion	**June – Sept**	**October - May**
AML	7.4	3.4
MDL	27.8	12.3

- These revised ammonia discharge limits for the Idaho Falls WWTF would be unlikely to significantly degrade dissolved oxygen in the river.

References

Chapra, S.C. 1997. Surface Water-Quality Modeling.

DEQ. 2011. Draft Idaho Antidegradation Implementation Procedure.

EPA. 2011. Water Quality Models and Tools – DFLOW. http://water.epa.gov/scitech/datait/models/dflow/index.cfm

EPA. 2010. Fact Sheet, NPDES Permit #ID0021261, City of Idaho Falls Wastewater Treatment Plant.

EPA. 2009. Fact Sheet, NPDES Permit #ID0020401, City of St. Anthony Wastewater Treatment Plant.

EPA. 1999. 1999 Update of Ambient Water Quality Criteria for Ammonia.

EPA. 1991. Technical Support Document for Water Quality-Based Toxics Control.

EPA. 1984. Ambient Water Quality Criteria for Ammonia.

IDAPA. 2011. 58.01.02 – Water Quality Standards. http://adm.idaho.gov/adminrules/rules/idapa58/0102.pdf.

USGS, 2011. StreamStats. http://water.usgs.gov/osw/streamstats/index.html