APPENDIX K

GSP/FP CORRESPONDENCE WITH DOE

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
1500 West 4th Avenue, Suite 305 • Spokane, Washington 99204
FAX (509) 456-2997

June 11, 1999

RECEIVED
JUN 14 1999
Gibbs & Olson, Inc.

Mr. Robert A. VanderZanden, P.E.
City of Woodland
PO Box 9
Woodland, Washington 98674

RE: CITY OF WOODLAND; WASTEWATER-REUSE: GENERAL SEWER PLAN; COWLITZ COUNTY; DOH PROJECT #98-1107

Dear Mr. VanderZanden:

The revised general sewer and facility plan received in our office on March 19, 1999, has been reviewed in accordance with the provisions of WAC 246-271 for conformance with the Water Reclamation and Reuse Standards, and is hereby **APPROVED.**

The revised plan addresses beneficial uses of reclaimed water as required by RCW 90.48.120. The assessment assumes Class D reclaimed water, yet assumes the need and cost for turbidity monitoring, which is required for Class A reclaimed water only. It is not apparent as to whether potential revenue from growing and harvesting hybrid poplars for paper pulp was considered in the cost estimates for implementation of this proposal. It is recommended that this potential reclaimed water option be investigated in more detail for inclusion in any future plans or updates.

Regulations establishing a schedule of fees for review and approval of planning, engineering, and construction documents were adopted June 30, 1998. An itemized bill for $504.00 is enclosed.

If you have any questions, please feel free to contact me.

Sincerely,

Craig L. Riley, P.E.
Interim Program Manager
Water Reclamation & Reuse Program
(509) 456-2466

CLR:drp

Enclosure

cc: Cowlitz County Health Department
Gibbs & Olson, Olympia
David Knight, WDOE, SWRO
Rich Hoey, WDOH, SWRO

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

August 11, 1999

Mr. Robert A VanderZanden, P.E.
Director of Public Works
City of Woodland
230 Davidson Avenue
P.O. Box 9
Woodland, WA 98674

Mr. Dick Riley P.E.
Gibbs and Olson, Inc.
1405 17th Avenue, Suite 300
P.O. Box 400
Longview, WA 98632

Dear Mr. VanderZanden and Mr. Riley:

Re: City of Woodland General Sewer Plan and Facility Plan, March 1999, Gibbs and Olson and the Gibbs and Olson Memorandum of August 3, 1999, Regarding the Same

We have reviewed the design of the proposed Sequencing Batch Reactor (SBR) for Woodland. The design proposed in the memorandum is approvable and the report content meets the content requirements of a general sewer plan and facility plan as established in Chapter 173-240 Washington Administrative Code (WAC).

In the course of our analysis, the Department of Ecology (Ecology) determined that with sludge handling options described and automation anticipated, a hydraulic retention time (HRT) based upon low water tank level (V) and maximum monthly average flows (Q) of 12 hours is approvable. The recognition, however, was not sufficient to authorize the capacity initially requested. We greatly appreciate the flexibility of the design team in achieving the workable solution to this and our loading concerns reflected in the memo of August 3, 1999. We are also quite pleased that plans received in the August 3 memo now include a third tank for capacity over 1.0 MGD. A three tank system provides significantly greater flexibility if one basin fails.

That design is approvable at the flow and loadings proposed. We find it is also a legitimate option to request a re-evaluation of capacity at a future date when and if design manuals and Ecology criteria recognize higher loading capacities for such systems.

We would like to return the three previously submitted copies of the document so you may post the changes to it reflective of the design modifications described in the August 3 memo and have the responsible engineer affix his or her seal to the documents as required by Chapter 173-240-160 WAC.

Please call me at (360) 407-6277 if you have any questions about this matter or to arrange pickup of the GSP/FP documents.

Sincerely,

David J. Knight, PE
Environmental Engineer
Water Quality Program
Southwest Regional Office

DJK:mf(9/wq)

cc: Chuck Meyer, Ecology
File: City of Woodland, Engineering

GIBBS & OLSON, INC.
since 1950

1405 - 17th Avenue, Suite 300 P.O. Box 400
Longview, Washington 98632
Fax 360/423-3162 Phone 360/425-0991

Memorandum

DATE: AUGUST 3, 1999

TO: DAVE KNIGHT – DOE SWRO **FAX: (360) 407-6305**

FROM: RICH GUSHMAN – GIBBS & OLSON, INC. **FAX: (360) 425-3162**

RE: WOODLAND GSP/FP REPORT SBR WWTP RECOMMENDATION

FILE: 876.4400.10

As we discussed this morning, the City of Woodland and Gibbs & Olson would like to modify the recommended SBR design contained in the above referenced report. The modified design recommendation would consist of modifying the basin dimensions so that a low water level HRT of 12 hours is provided for the MMA flow of 2.0 MGD and an F:M ratio of 0.10 lbs BOD5/lb MLSS is not exceeded at the projected wasteload of 3,107 lbs BOD5/day.

As discussed, the Phase I improvements which are scheduled to begin construction in 2000 will consist of two SBR basins and a third basin will be added when the Phase II improvements are required (projected to be around 2010). A summary of the proposed design criteria related to the SBR basins for both Phase I and Phase II is presented below.

SBR Design Criteria for HRT and F:M Ratio – Woodland, Washington		
	Phase I	**Phase II**
Max. Monthly Average Flow	**1.0 MGD**	**2.0 MGD**
Influent BOD5 Wasteload	**1,986 lbs/day**	**3,107 lbs/day**
Number of SBR Basins	**2**	**3**
Basin Dimensions	**75' long x 50' wide x 12' low water level (variable volume depth = 8 feet)**	**75' long x 50' wide x 12' low water level (variable volume depth = 8 feet)**
Total Low Water Level Volume (Aqua-Aerobic Systems approach)	**673,246 gallons**	**1,009,869 gallons**
Total Variable Volume (Aqua-Aerobic Systems approach)	**448,832 gallons**	**673,248 gallons**
Total SBR Volume at Max Level	**1,122,078 gallons**	**1,683,117 gallons**
Low Water Level HRT at MMA	**673,246/1,000,000 = 0.67 days = 16.2 hours**	**1,009,869/2,000,000 = 0.50 days = 12.1 hours**
Design MLSS Concentration at Low Water Level	**4,000 mg/l**	**4,000 mg/l**
Biological Mass in Basins	**22,462 lbs**	**33,693 lbs**
F:M Ratio in terms of MLSS (Unadjusted for aeration)	**1,986/22,462 = 0.088**	**3,107/33,693 = 0.092**

Note: The proposed SBR system could handle up to 2,246 lbs BOD5/day for Phase I and up to 3,369 lbs BOD5/day for Phase II and still meet the 0.1 F:M ratio allowed and the 12 hour low water level HRT. Additional BOD capacity could be gained if the low water level MLSS concentration is increased from 4,000 mg/l to 4,500 mg/l which is a typical value utilized by Aqua-Aerobic Systems in sizing basins.

We will modify the GSP/FP report to incorporate these changes if this concept is acceptable to DOE as we discussed this morning. Other things related to the SBR system will also change such as the decant rate required (it will decrease with 3 basins) and possibly the post-equalization basin volume required. The required modifications will be addressed in either the final GSP/FP report or in a response letter to DOE which will be incorporated into the final GSP/FP report. If you have any questions regarding the concept as presented in this memorandum please call me at (360) 425-0991. Thank you.

DRAFT MEMORANDUM FOR RECORD:

Record of Meetings and Design Review Notes:

TO: John Diamant, Gibbs and Olson; Tel# 360-425-0991; FAX# 360-423-3162; gibsolsn@cport.com

FROM: David J. Knight, PE

RE: Review of Woodland General Sewer Plan, now submitted as a Facility Plan as well.

QC: Kathy Cupps, having dealt with Orting and Yelm SBR design approvals was tasked to review, and concurred with the enclosed analysis for consistency. Despite my attempts to reach consensus there were some areas of concern not resolved during the June 22, 1999 meeting with Gibbs and Olson and City. Principal among them was the sizing of the SBR's. Other issues discussed are included for background:

1. SBR DETAILS: I had initially felt that details of design of the SBR's Tank, Decanter, Aerator and Mixer, Electrical, and Controls were necessary in order to review and approve the submittal as a Facilities Plan. While the Criteria for Sewage Works Design is a necessary general design reference, you had provided me a better reference for the desired scope and level of detail we are looking for specific to SBR's in the form of the Iowa Department of Natural Resources Design Guidance. I provided this to G&O at the meeting and we reached a general understanding that the supplier would be asked to meet these criteria in the bidding process, and that our review of plans and specifications would generally examine compliance with these criteria. One criteria that was not agreed to be met was the Iowa three tank standard. According to G&O's designer Richard Gushman, 99%+ of SBR's are two tank systems, and that is what they intend to install at Woodland. While I cannot boast at having reviewed enough designs to refute this statement, I felt it important to note that most SBR's are for <0.5 MGD as well. The desired MMA flow rate for this system is closer to 2.0 MGD, which merits a higher standard of redundancy or reliability.

2. SBR SIZING REVIEW FOR PHASE I PLANS: I discussed that I had found that sizing of SBR's for phase 1 is marginally below DOE standards. Rich Gushman from G&O contended that other SBR's were not designed to DOE's standards and informed me that phase I tank sizes were not actually a legitimate option. They desired to build phase II tanks facilities from the outset. This was not clear in the submittal. When the subject of Hydraulic Retention Time arose, Mr. Riley alluded to Orting and Arlington having HRT's of 12.7 hours and 25.4 hours, and Mr. Gushman felt that average dry weather flow, rather than MMA was reasonable to use in applying this criteria. I felt that Arlington and Orting would be of equivalent size and loadings, so I decided to do a comparison of these systems after the meeting and review Mr. Riley's information.

   ARLINGTON REVIEW/COMPARISON: I called Jeff Howard (425) 455-9494, the designer of the Arlington Plant and the principal contributing author of this section of Ecology's Criteria for Sewage Works Design. He first clarified that the intent of the 18 Hour low-water Hydraulic Retention Time (HRT) standard was to be based on the Maximum Monthly Average (MMA) design flows as I had presumed. He said that he also believed that Arlington met this standard. I then spoke with Terry Castle of the City of Arlington (360) 435-3811. He confirmed that the two tanks were each 135 feet long by 60 wide with a minimum water depth of 17.5 feet (22.5 max), and that it was rated at 2.0 MGD as a MMA (he believed there was 1.06 MG volume for each basin at low water, which I confirmed). Therefore total low water volume level was 2.12 MG, and HRT is 2.12/2.0 or 1.06 days (25.44 hours) at MMA flows (Mr. Riley was correct). BOD loading rates presuming a 4,000 mg/l MLSS in the decanted tanks and a 200 mg/l influent strength would be 0.065 lbBOD/lbMLVSS/day. Design presumes that City will eventually go from 2.0 to 3.0 MGD MMA flow capacity using the existing tankage (essentially reducing the HRT to 17.0 hours and increasing loading to 0.097 lbBOD/lbMLVSS/d).

ORTING REVIEW/COMPARISON: The City of Orting obtained approval for design of a 1.8 MGD (MMA) plant consisting of three SBR basins (I guess this is part of the 1% that's not a 2 basin system), each having a 568,000 gallon maximum volume. Plans and specifications show system minimum volume. The top of the walkway is 20' above the floor of the basins (180' elevation). The contract documents for the control strategies (p. 17500-1 to 17500-7) state that the water level will be at 170' elevation minimum for all operational modes, with 160' elevation being the elevation of the bottom of the tank, and that the tanks (p.17500-4) have a volume of 31,285 gallons per foot of elevation. The low water level volume therefore is 10 feet, or 938,550 gallons at the approved 1.8 MGD flow. Working volume is 4 to 8 feet above the low water level, yielding an actual maximum volume of 1.7 million gallons in the three tanks (confirming the engineering report). This yields a low water HRT of 12.5 hours based upon MMA flows. It must be emphasized, however, that the present criteria for sewerage works design was not in place at the time of the approval of this plan. According to Ecology's reviewer, were the present standards in place, they would have also been required to meet the 18 hour HRT requirement. Furthermore, the facility received a much weaker influent. The design loading is only 2,171 lbBOD/day. This yields a loading rate of 2,171lb/day / (938,550 * 2920 * 8.34lb) or 0.095 lbBOD/lbMLVSS/day, which meets the new Ecology Criteria. (NOTE: Mr. Riley was again right on, but interestingly while these HRT's are based upon MMA flows, G&O's designer, Mr. Gushman used the more generous average dry weather flow basis for calculating this parameter.)

YELM: I did not seriously consider reviewing the system for Yelm versus the proposed design. My understanding is that Yelm employs a STE system, and therefore would have a much lower carbon source, hence lower sludge production, hence a much greater sludge age due to the lower growth that would come from the influent. Due to sludge age, nitrification would almost certainly have to be provided for, but loading would be much lower. In short, I thought there are just too many differences in how the Yelm system would have to be designed to make meaningful comparisons with regards to component sizing. If you can draw any comparisons from the Yelm situation, please let me know.

3. I re-emphasized at the meeting that the two criteria which we feel must be met to satisfying reasonable sizing estimation needs of a General Sewer Plan are the loading and hydraulic retention criteria. Ecology's 12/98 Criteria for sewerage works design requires an 18 hour hydraulic retention time based on the tank low water level, and a loading rate of between 0.05 and 0.10 lbBOD/lbMLVSS. The proposed sizing of SBR tanks for phase 2 (p.VIII-4) is two 84' by 56' tanks with a minimum volume of 351,859 gallons each at the given low water level of 10 feet. The HRT for the phase II SBC design submitted is therefore only nine (9) hours at MMA flows of 1.87 MGD. The tankage volume at low water level is only half of what is necessary to meet Ecology's HRT criteria.

4. The second evaluation I did was to determine whether the organic loading rate at MMA flows is within Ecology's recommended design loading rate of 0.1 lbBOD/lbMLVSS/day. It was clarified in the meeting on 6/21/99 that the design MLVSS given was for the tank at low water level, not high water level as I had presumed. Therefore the MLVSS mass in the tanks was much lower than I had presumed. The MLVSS (total of both) can be calculated as the low water tank volume in millions of gallons ((2eaX10'X84'X56' cf * 7.48 gal/cf) / 100000) * MLVSS concentration in the decanted liquid (2,920 parts per million) * conversion to pounds (8.34 lb/gal). This yields a total MLVSS mass of 17,137 lb. Even presuming that high strength users are controlled to 300 mg/l (which there is no sign of happening yet), loadings will not be reduced by primary clarification, and MMA loadings to the SBR's will be as presumed at the headworks 3,107 lb/day (p. V-11). Therefore the loading rate is 0.18 lbBOD/lbMLVSS/day, which is outside the range given in Ecology's criteria of 0.05 to 0.10 lbBOD/lbMLVSS/day.

5. SUMMARY: I strongly recommend at least three SBR's, but feel comfortable authorizing the construction of either the proposed phase 1 or phase 2 design at a recognized loading capacity of 0.94 MGD (rather than the desired rating) if easily maintainable systems as described in our meeting are installed. I will ask the City whether they wish to proceed with a lower rated capacity or revise their plans to meet the target year 2009 and 2023 capacities and have 3 or more tanks.

6. CONTINUING SBC CONCERNS: I expressed at the meeting that I retained some concern that the sizing of SBC's used for cost comparison is still inadequate, but that I am willing to accept the current information in a general sewer plan that does not select this as the method of treatment. We can get by without critically reviewing methods not chosen in a general sewer plan. The Public Works Director (Rob Vanderzanden) wished, however, to discuss the issue. I related that I accept that the soluble biochemical oxygen demand (SBOD5) loading rate is a better criteria for sizing the SBC units than BOD5. I asked for a consensus on this during our meeting but did not feel I had received it. I still think it would be good to reach consensus on this. My analysis of the data submitted shows that the SBOD levels experienced by the currently operating SBC/SBR system have reached a maximum rate of about 1.03 and 1.18 lb/day of SBOD per 1,000 square feet of media in the Summer and Winter respectively. Operator reports have confirmed our previous presumptions that this is pushing the maximum level the facility can safely and reliably accommodate. (Table VII-5 shows 429 lb/day as the 99 percentile dry weather SBOD loading rate and Table VII-8 estimates 492 as the 90%ile SBOD loading rate in the winter. The total media surface area is given as 415.7 * 1,000 square feet. The Ecology standard since the 1985 Criteria for Sewerage Works Design has been 1.1 lb SBOD / 1,000 SF of media. I think that this is still a good standard to apply for Woodland. Historical data shows this standard has been met in the Summer, and only marginally exceeded in the Winter.)

   The plans for Phase 1 and Phase 2 indicate that BOD loading to the SBC's (page VII-51) are estimated to be 1,324 and 2,071 lb/day for phase 1 and 2 respectively, and page VII-51 notes that a SBOD/BOD ratio of 0.6 is appropriate. This equates to a SBOD loading estimations as maximum monthly averages of 0.138 lb SBOD/capita currently; 0.130 lb SBOD/capita for phase 1 (1,324lb*0.6 / 6,111 RE); and 0.103 lb SBOD/capita (2.071lb*0.6 / 12,089 RE) for phase 2. Even with these somewhat optimistic loading rates (intended reductions of high strength users have not been accomplished), phase 1 and 2 treatment facilities as designed will be loaded at a maximum monthly average rate of 1.39 (794lb / 571.4 ksf) and 1.44 lb/day/1,000sf (1,234lb / 857.1 ksf). To maintain compliance with an SBOD design loading standard of 1.1 lb/day/1,000sf, with two and three banks of SBC's, maximum monthly average flows would have to be limited to 0.80 MGD and 1.43 MGD for phases 1 and 2 respectively. After the meeting, I felt that we could consider authorizing construction of the described SBC units at those (0.8 and 1.43 MGD) loading rates. Cost estimates reflecting the use of an additional bank of SBC's in both cases to meet the target loading rates are important because of their impact on the bottom line. Since the SBR's only seem adequate for 50% of the flow, a design satisfying our criteria at the design MMA flows could lead to inappropriate changes to the bottom line if this remains unaddressed.

7. DISINFECTION NOTES: At the meeting I discussed that the UltraViolet (UV) disinfection size would be minimized and mixing zone ratios would be enhanced by post equalization. The designer did not appear to feel this was presently an important consideration. I must concur that it doesn't mean the difference between having to nitrify or not since the EQ basin will be used during the critical season. The report describes a 100,000 gallon Equalization Basin to be used during low river flow conditions. Use of this basin during all periods, specifically during high flow periods would reduce the maximum discharge rate from 4.8 MGD to 2.6 MGD during phase 1. Therefore the UV system could be sized for 2.6 MGD or redundant systems could be installed for the same price. To reduce the phase 2 maximum flow rate to 2.6 MGD using the system described on pages VII-54 and VIII-4 would require a 200,000 gallon tank (decant rate of 5,000 gpm and two tanks). However, if four of the phase 1 tanks are used to meet phase 2 flow requirements, our calculations indicate that the single 100,000 gallon tank will still be sufficient to equalize even phase 2 flows to a 2.6 MGD peak flow rate.

8. SLUDGE DIGESTION: The PAD Process appears to be an ideal solution to the sludge digestion question, however, if phase 1 only includes one 100,000 gallon sludge tank, the PAD process, our understanding of the PAD process as described, which requires at least two tanks, will not be able to be employed. The designer clarified that both tanks will be installed in phase I. This will need to be captured for the record.

9. SBR SYSTEM OPERATION NOTES: The SBR cycle description on p. VIII-3 defines "cycle time" as involving all steps, with fill occurring over the first half of the cycle time, and the React, Settle,

Decant, Sludge Wasting, and idle steps occurring during the second half. The tank would be aerated (constantly or intermittently) and mixed (also either constantly or intermittently) during the fill time. This activity, however, has not typically been counted as part of the cycle time. My previous analysis presumed the 4.8 hour (288 minute) cycle time would begin after the fill, and include the react, settle, decant, and idle steps. I learned that the intent was that filling would occur during the first half of the cycle time and translate to an actual cycle time of only 2.4 hours. Rich Gushman, G&O's design engineer on this project explained that this is broken down into a react time of 47 minutes, a settle time of 45 minutes, and a decant time of 60 minutes. I later noted that this is eight minutes more than 2.4 hours, and there is no sludge wasting time built in. My primary concern, however is that the react time may not be long enough to achieve appropriate treatment. He thought it would be because aeration is happening as fill occurs, however, my understanding is that this has always been the case with such systems. Previously EPA recommended 35% of total cycle time be react time. To meet this guidance, keeping the settle and decant times the same would equate to a react time of 350 minutes, a fill time of 455 minutes, and a total cycle time of 910 minutes (15.2 hours). I do not propose this standard be adhered to, but the difference is quite great. Basically, by previous EPA "rule of thumb" methods, the cycle time would have to be over three times it's present length. My opinion is that if the HRT and loading rates are adjusted to meet Ecology's criteria, cycle time can be later adjusted to optimize the level of treatment.

10. PROJECT MANAGEMENT: I discussed during the meeting that the map following p. VIII-9 needs to identify which facilities will be constructed during phase 1 and which during phase 2. I would prefer separate maps for each phase or a map that is color coded to each phase for appropriate clarity in regards to the phasing of the project for the Engineering Report. I understand that the City would like to bid this project soon, but cannot concur that the design submitted will accommodate the flows and loadings the City wishes to accommodate with this upgrade.

From: Knight, David J. (SWRO) <dakn461@ECY.WA.GOV>
To: 'Rob Vanderzandan' <publicwk@teleport.com>
Cc: 'John Diamant' <john diamant<gibsolsn@cport.com> > <'John Diamant' <john diamant<gibsolsn@cport.com> >>
Date: Thursday, June 17, 1999 10:39 AM
Subject: Meeting on Monday 6/21/99 at 9:00

Dear Mr. Vanderzandan:

I am sending you this in response to G&O's request for specific points and observations to guide and enhance the productivity of our schedule meeting on Monday. Here are my observations on the current submittal and areas I think that discussion would move us forward. I would like to give you the opportunity to set the agenda for our meeting in consideration of this input.

<<GSP review 2.doc>>
Here's a spreadsheet of the important design information I gleaned from the report, and the evaluation formulas that I used on this evaluation.

<<Woodland_eval.xls>> .

DRAFT

Review Notes on Woodland General Sewer Plan, now submitted as a Facility Plan as well:

Discussion Points:

1. SCOPE OF SUBMITTAL: The subject report is being submitted as a Facility Plan as well as a General Sewer Plan. The draft document only was submitted as a General Sewer Plan. Therefore, while it included far more than the minimum necessary content for General Sewer Plans, it was not reviewed for content required in a Facility Plan. Required content is discussed in chapter G-1 of Ecology's 12/98 Criteria for Sewage Works Design. . Facility Plan requirements are specifically discussed between pages G1-17 and G1-25. We would like to discuss keeping this report as a general sewer plan and having a future submittal serve as the Facilities Plan.

2. COMBINING FACILITIES PLAN REQUIREMENTS IN GENERAL: Since this report is now being submitted as a Facilities Plan as well as a General Sewer Plan, it needs to include NEPA requirements, detail sufficient to prepare plans and specifications from the document, and satisfy the requirements of Engineering Reports listed in WAC 173-240-060. It would greatly speed up the review time if the submittal included a cross reference from requirements to content location

3. DETAILS OF SBR SYSTEMS EXPECTED IN FACILITY PLANS: Details of design of the SBR's Tank, Decanter, Aerator and Mixer, Electrical, and Controls are necessary in order to review and approve the submittal as a Facilities Plan. While the Criteria for Sewage Works Design is a necessary general design reference, a better reference for the desired scope of the level of detail we are looking for specific to SBR's is the Iowa Department of Natural Resources Design Guidance. We will provide and will be prepared to discuss this at the meeting if desired.

4. SBR SIZING REVIEW FOR PHASE I PLANS: We found that sizing of SBR's for phase 1 is marginally below DOE standards. All SBR calculations are new to this document. Therefore, this is our first look at plans for sizing these units. The two criteria which we feel must be met to satisfying reasonable sizing estimation needs of a General Sewer Plan are the loading and hydraulic retention criteria. Ecology's 12/98 Criteria for sewerage works design requires an 18 hour hydraulic retention time based on the tank low water level, and a loading rate of between 0.05 and 0.10 lbBOD/lbMLVSS. Phase 1 is described as using two tanks each 70' by 48' with total working depth of 22' and a low water depth of 14'. This yields a hydraulic retention time, based on the maximum monthly average (MMA) flows of 16.72 hours at low water volume. At an 18 hour HRT, the MMA flow would be 0.94 MGD. The organic loading rates in both cases are within the required design criteria. Clear water level will be 5.89 feet below the low water level assuming a settled solids concentration of 8,000 mg/l. This allows ample flexibility for peak day flows.

5. SBR SIZING REVIEW FOR PHASE II PLANS: We found the sizing of SBR's for phase 2 appears inadequate for the design loadings. We also have serious reservations about a different size tank than described for phase 1. The report describes two 84' by 56' tanks for phase 2. This would generally entail abandoning or destruction of the phase 1 tanks which are described as 70' by 48'. Secondly, the HRT is only nine hours at MMA flows. This is half of what is necessary. The clear water level would be less than one foot below the tank low water level assuming an 8,000 mg/l settled solids concentration. Lastly, the organic loading rate at MMA flows exceeds Ecology's upper design limit of 0.1 lbBOD/lbMLVSS. This provides little flexibility for high flows or days when solids are poorly settling. We strongly recommend instead that four of the phase 1 SBR's be used to meet the phase 2 design MMA goal of 1.87 MGD. Three SBR's is the minimum recommended number of units, but we could approve plans with two that include phased expansion to three or more units. Four of the phase 1 SBR units described would yield exactly the 18 hour HRT required, provide additional redundancy, and increased peak flow capacity, and meet organic loading requirements.

6. CONTINUING SBC CONCERNS: We retain some concern that the sizing of SBC's used for cost comparison is still inadequate, but are willing to accept the current information in a general sewer plan that does not select this as the method of treatment. We can get by without critically reviewing methods not chosen in a general sewer plan, so if that is acceptable, skip the rest of this comment. Otherwise, our analysis and comments follow: We accept that the soluble biochemical oxygen demand (SBOD5) loading rate is a better criteria for sizing the SBC units than BOD5. It would be good to reach consensus on this. Our analysis of the data submitted shows that the SBOD levels experienced by the currently operating SBC/SBR system are at a maximum rate of about 1.03 and 1.18 lb/day of SBOD per 1,000 square feet of media in the Summer and Winter respectively. Operator reports have confirmed our previous presumptions that this is pushing the maximum level the facility can accommodate. Table VII-5 shows 429 lb/day as the 99 percentile dry weather SBOD loading rate and Table VII-8 estimates 492 as the 90%ile SBOD loading rate in the winter. The total media surface area is given as 415.7 * 1,000 square feet. The Ecology standard in the 1985 Criteria for Sewerage Works Design has been 1.1 lb SBOD / 1,000 SF of media. Historical data shows this standard has not been exceeded in the Summer, and has only been marginally exceeded in the Winter. The plans for Phase 1 and Phase 2 indicate that BOD loading to the SBC's (page VII-51) are estimated to be 1,324 and 2,071 lb/day for phase 1 and 2 respectively, and page VII-51 notes that a SBOD/BOD ratio of 0.6 is appropriate. This equates to a SBOD loading estimations of 0.138 lb SBOD/capita currently; 0.130 lb SBOD/capita for phase 1; and 0.285lb SBOD/capita for phase 2. Even with these somewhat optimistic loading rates (current per capita loadings are higher), phase 1 and 2 treatment facilities as designed will be loaded at a maximum monthly average rate of 1.39 and 1.44 lb/day/1,000sf. To maintain compliance with an SBOD design loading standard of 1.1 lb/day/1,000sf, with two and three banks of SBC's, maximum monthly average flows would have to be limited to 0.80 MGD and 1.43 MGD for phases 1 and 2. Cost estimates reflecting the use of an additional bank of SBC's in both cases to meet the target loading rates are important because of their impact on the bottom line. Final design of the SBR's may include features that are more expensive than currently estimated, which could lead to inappropriate changes to the bottom line if this remains unaddressed.

7. DISINFECTION NOTES: The UltraViolet (UV) disinfection size would be minimized and mixing zone ratios would be enhanced by equalization, but it was difficult to determine to what degree this had been considered.. The report describes a 100,000 gallon Equalization Basin to be used during low river flow conditions. Use of this basin during all periods, specifically during high flow periods would reduce the maximum discharge rate from 4.8 MGD to 2.6 MGD during phase 1. Therefore the UV system could be sized for 2.6 MGD or redundant systems could be installed for the same price. To reduce the phase 2 maximum flow rate to 2.6 MGD using the system described on pages VII-54 and VIII-4 would require a 200,000 gallon tank (decant rate of 5,000 gpm and two tanks). However, if four of the phase 1 tanks are used to meet phase 2 flow requirements, our calculations indicate that the single 100,000 gallon tank will still be sufficient to equalize even phase 2 flows to a 2.6 MGD peak flow rate.

8. MIXING ZONE PRESUMPTIONS: The mixing zone analyses conducted for this plan provides a general estimation of required treatment. Ideally such analyses recognize that acute standards are based upon the maximum (1-hour) flow rate and chronic standards are based upon a 4-day average flow rate. We accept that the 7Q10 estimate of 798 cfs is appropriate for establishing acute and chronic mixing zone ratios. We accept that the best current data indicates 7Q10 stream width of 281 feet, centerline depth of 3.0 feet, and flow velocity of 1.01 fps. Estimates of a peak daily value of 10 mg/l of ammonia, while possibly reflective of current performance, are not appropriate to use for treatment facilities that are being designed without consideration for providing nitrification. The intent of the analysis is to determine if treatment for ammonia is required. Presuming that the effluent is at 10 mg/l for ammonia as a worst case presumes that nitrification will be provided in the new facility. The body of the report does not reinforce that this is a design criteria. For estimating whether nitrification is required, raw wastewater ammonia levels should be presumed in the effluent for proposed facilities. This will determine if the new facility should be designed to provide a degree of nitrification. Using a 30 mg/l ammonia concentration for phase 1 and 2 analyses would therefore be appropriate.

9. **MIXING ZONE MODEL:** Upon review, we concluded that the use of the Very Shallow Water (VSW) analysis appeared properly performed for flow rates of 0.46; 0.78; 1.57; and 5.0 MGD. We agree this is an appropriate method to use in this case. The acute mixing zone ratios will depend on the peak hour flow rate, which wasn't definitively established, but a 100,000 gallon equalization tank should limit this to 2.6 MGD for phase 1, and 5.0 MGD for phase II. Chronic mixing zones, however, should be based upon MMA flows rather than average wet weather flows as done in the submitted analysis. Therefore, MMA flow rates of 1.01 and 1.87 MGD for phase I and II respectively are more consistent with our guidance for conducting the chronic mixing zone ratio analysis than the 0.78 and 1.57 MGD flow rates used.

10. **FUTURE APPLICABILITY OF MIXING ESTIMATES:** As a note of caution, it would be inappropriate to presume any long term certainty exists with respect to the current estimates of the mixing at the edges of the acute and chronic mixing zones. In time, the presumptions upon which the analysis is based will change. The tools used to estimate the mixing zone ratios for this situation will also change. This potential for change increases with the length of time between approval of plans and the permit development. Our permitting requires use of the best and most current information to determine mixing zones and reasonable potential to exceed water quality standards at the time the permit is drafted. Mixing zones estimates are not guarantees and are not "grandfathered" in by our approval of the document. In cases where a mixing zone estimate is reduced to the point where a higher level of treatment is required than was previously estimated, a compliance schedule would almost certainly be appropriate. This would provide the time needed to construct the newly required higher level of treatment.

11. **SLUDGE DIGESTION:** The PAD Process appears to be an ideal solution to the sludge digestion question, however, if phase 1 only includes one 100,000 gallon sludge tank, the PAD process, our understanding of the PAD process as described, which requires at least two tanks, will not be able to be employed. Therefore we need the report to provide greater clarity on the plan for sludge digestion for phase 1 in the Engineering Report.

12. **SBR SYSTEM OPERATION NOTES:** The SBR cycle description on p. VIII-3 is not consistent with our presumptions of "cycle time". Typically we presume "cycle time" starts when fill time is finished. It involves the React, Settle, Decant, and Idle steps. The tank may be aerated (constantly or intermittently) and mixed (also either constantly or intermittently) during the fill time. This activity, however, is not typically counted as part of the cycle time. Therefore we presume the 4.8 hour (288 minute) cycle time would begin after the fill, and include the react, settle, decant, and idle steps. Presuming that filling occurs during the first half of the cycle time translates to an actual cycle time of only 2.4 hours. We have concerns that that is not long enough to achieve appropriate reaction, settling, and decanting (decanting will take over 60 minutes by the volume and flow rates given.

13. **PROJECT MANAGEMENT:** The map following p. VIII-9 does not identify which facilities will be constructed during phase 1 and which during phase 2. We really need separate maps for each phase or a map that is color coded to each phase for appropriate clarity in regards to the phasing of the project for the Engineering Report. We would like to discuss plans for development of plans and specifications and a QAPP. What time frames are possible?

Woodland GSP Review

Blue = estimated or calculated parameter not found in report
Green = Applicable Ecology or Text Design Standard
Sizing Criteria for Woodland Wastewater Treatment Plant

Design Parameters

	Current	Phase 1	Phase 2	NOTE:
Average annual flow	0.383	0.71	1.4	Table V-6 equates to Des. MM of .48 MGD
Average Dry Weather Flow	0.358	0.64	1.28	Phase 2 estimated by 105 gpd/capita * 12,089 pop.
Average Wet Weather Flow	0.435	0.77	1.52	Ph. 2 from table V-4 pg. V-7
Maximum Monthly	0.883	1.01	1.87	Current design MM = .48 MGD
Peak Daily Flow	1.208	1.62	3.2	Ph 2 from table V-4
Peaking factor Pkday/ADWF	3.4		2.5	
Peaking factor MM/ADWF	1.92		1.46	
Ave I&I (max mo-ave dry)	0.33		0.59	Phase 2 est. 0.33 + 30gpd/c * 8,518 new pop.
Peak I&I	0.85		0.68	From p. V-8

	Current	Phase 1	Phase 2	Note
90%ile BOD Conc. mg/L	372	372	290	Raco wasteload study (p.v-10) for ph2.
Total DW loading lb/d	1,105	1,985	3,107	p. V-11
Industrial Loading lb/d	442			
Domestic Loading lb/d	663			By subtraction
Population	3570	6,111	12,089	
Per Capita Loading (tot)	0.31	0.325	0.257	lb BOD/capita/day including industrial
Per Capita Load (dom DW)	0.19		0.22	lb BOD/capita/day in dry weather
Historical BOD loading 95%	1300			Figure IV-12 - lb/day
Historical BOD loading 50%	1,000			Current ave annual design load = 800 lb/d
Soluble/total BOD ratio	0.38			(Dry season data, p.VII-11; Wet Weather ratio presumed = .38 table VII-6)
90%ile WW Daily Max BOD	1,296			Table VII-6 - at 341 mg/l BOD ave and flow ave = .456 mgd

	Current	Phase 1	Phase 2	Note
Historical TSS conc 95%	400			mg/l
Historical TSS conc 50%	310			mg/l
Historical TSS Load 95%	1,250			lb/d
Historical TSS Load 50%	1,010			lb/d
TSS Concentration used	388	388	296	mg/L (Ph.2 presumes industries reduced to 300 mg/L)
TSS Des. Load Rate Used	1,152	2,071	3,160	lb/d

	Current	Phase 1	Phase 2	Note
Influent Ammonia assumed	30	30	30	mg/L
90%ile ammonia	30			mg/L
Ammonia Loading Used	89	160	320	lb/day

Headworks Design

	Current	Phase 1	Phase 2	Note
Peak Cap. (2 units for ph2)	2.5	2.5	5	Hycor Helisieve HLS400P
Grit Chamber SA, sf	93.5			
Grit Chamber Depth, ft	8			
Grit Removal Operation	Manual			

Primary Clarifier

	Current	Phase 1	Phase 2	Note
Diameter ft	28	N/A	N/A	28'dia = 615 sf
Depth, sidewater, ft	8.6			
PkDay Surface Overflow Rt	1,950			gpd/sf
MMA Surface Overflow Rt	780			gpd/sf
Weir Overflow Rate (PD)	14,700			gpd/lf
Weir Overflow Rate (MMA)	6,900			gpd/lf
Primary Removal Rate	0.52			observed range .34 - .60

SBC Loading Rates Used

		For SBC opt.	For SBC Opt.	Note
BOD Load to SBC's (lb/d)	800	1,324	2,071	After primary clarifier lb/day p.VII-51
Soluble BOD Load to SBC's	429	794	1,234	data & SBOD/BOD ratio of .6 assumption on p. VII-51
First Stage lb/d/1000sf	5.4	4.46	4.65	DOE Criteria max - 5.0 (Table V-6 sets des BOD = 800lb/d
Total System lb/d/1000sf	1.9	2.3	2.4	DOE Criteria max - 2.0
Max SBOD tot loading Rate	1.03	1.39	1.44	99%ile SBOD load = 429lb/d, table VII-5
First Stage SA (x1000sf)	148.5	297	445.5	1,2,&3 units respectively
Total SBC SA (x1000sf)	285.7	571.4	857.1	
Total RBC SA (x1,000sf)	130	0	0	
Total Media SA (x1000sf)	415.7	571.4	857.1	

Secondary Clarifier

	Current	Phase 1	Phase 2	Note
Diameter (ft)	32	32	32	1,2,and 4 each respectively
Total Surface Area (sf)	804	1608	3216	
Max Sidewater Depth (ft)	12.1	12	12	
Design MMA SOR	600	628	581	Gal/d/sf - 700 is DOE std.
Design Peak day SOR	1,495	1,007	995	Gal/d/sf - 1200 is DOE std.

Woodland GSP Review

Chlorine Contact Basins

Volume (gal)	20000			
Detention Time MMA (min)	60			60 minutes is std
Detention Time PD (min)	24			20 minutes is std

Effluent Pipe

Diameter 1 (110') inches	15	24	24
Diameter 2 (940') inches	16	24	24
Force Main Dia (River EP-18')	8		
Pumps (2 @ 850 gpm)	2*850 gpm		

Sludge Digestors (# of)	1	1	2	(Note: PAD process needs 2)
Size Diameter (ft)	25	30	30	(ft)
Sidewater Depth (ft)	17.5	20	20	(ft)
Volume	75,000	105,746	211,492	(gal)
Vol. Solids Load (lbVS/d/cf)	0.074	0.10	0.07	(.1 - .3 is standard)
Mass Loading (lb VS/d)	740	1381.8	2102.4	(Table on p.VII-70; Info on p.VII-54)
Aeration Cap (scfm @ 8psi)	420	(det later)	(det later)	(Turnover every 30 min.)
Design Air Rate (scfm/kcf)	38.5	30	30	(kcf = 1,000 cubic foot; pVII-70)
HRT	21.5	20	20	21.5 = current not design
Degree Days (temp*HRT)	344	PAD	PAD	475 is std for 40% VS reduction

(depends on temp. of reactor)

Sequencing Batch Reactor Design

Number of Basins		2	2	(each have surface areas of 70'x48' & 84'x56' respectively)
Length each		70	84	(ft)
Width each		48	56	(ft)
Total surface area (sf)		6720	9408	(for both tanks)
total depth		22	19	(ft)
Depth at low water level		14	10	(ft)
Volume full		1105843.2	1337064.96	(gal)
Volume Low Water		703718.4	703718.4	(gal)
Submitted HRT for ADWF		26.4	13.2	(hr - from Table VII-25)
Low water HRT ADW (hrs)		26.39	13.19	(18 hrs is DOE standard)
Low water HRT MMA (hrs)		16.72	9.03	
Tank % Inc. to meet HRT std.		7.64%	99.30%	(Need 4 of the phase 1 units for phase 2 to meet the HRT req'ts.)

Solving Design for HRT

Design HRT (hrs)		18	18	18 is Ecology criteria p. T3-21
Design Flow (MMA)		1.01	1.87	(MGD)
% tank vol decanted / cycle		36.36%	47.37%	
Min. Req'd Vol. (Million Gal)		0.67	1.01	(Peak flow * HRT)/((% tank volume decanted per cycle)*(cycles/day))
Design max. F:M ratio		0.1	0.1	
Design MLSS		4000	4000	(mg/L)
Req'd MLVSS (ppm)		2153.37	2786.27	(design BOD gal) / (tankvol*F:Mratio)
MLVSS:MLSS Ratio		0.73	0.73	
Req'd MLSS		2949.83	3816.80	(mg/L)
MLSS Conc. In settled solids		8000	8000	(Presumption only)
Clear Water after decant		5.89	0.94	(ft)

Decant Rate		8,333	6,000	(gpm)
Decant Time / Tank		60.32	63.33	(minutes)
Target Max. Discharge rate		2.60	2.60	(MGD)
Volume over max. flow rate		92143	202319.04	(gallons)

(equates to storage volume needed to maintain 2.6 MGD peak flow rate for UV system)

Peak Flow Decant
1.6 MGD dry, 1.5 pf for peak hr.

Fill = 200,000 gal

Time = 2 hrs min.
React = 1hr

Settle = 1 hr
Decant = 1 hr

Decant

Interpolation of OZ Model

at 2.6 MGD	Dilution	Horiz Distance	
	5.7 :1	6.3	
	8.0 :1	11.09	
Acute	7.1 :1	9.23	(Phase 1 acute flow w/equalization tank)
	45.2 :1	70.21	
	63.9 :1	97.49	
Chronic	60.4 :1	92.35	

at 4.8 MGD			
	5.7 :1	6.687	
	8.0 :1	12.61	
Acute	6.6 :1	9.23	(Phase 2 acute flow w/equalization tank)
	32.0 :1	76.45	
	45.2 :1	105.9	
Chronic	39.1 :1	92.35	

at 7.2 MGD	5.7 :1	7.052
	6.0 :1	13.74
Acute	6.4 :1	9.23
	22.6 :1	69.77
	32.0 :1	101.1
Chronic	29.3 :1	92.35