1200 King County Courthouse
516 Third Avenue
Seattle, WA 98104

KING COUNTY

Signature Report

June 2, 2004

Motion 11930

Proposed No. 2004-0203.2 **Sponsors** Edmonds

A MOTION to approve an evaluation of alternative project delivery methods for the Sammamish reclaimed water project in an effort to reduce overall project costs.

WHEREAS, the Washington state legislature expressly encouraged the development and use of reclaimed water through Washington's Reclaimed Water Act (chapter 90.46 RCW), by stating:

It is hereby declared that the people of the state of Washington have a primary interest in the development of facilities to provide reclaimed water to replace potable water in nonpotable applications, to supplement existing surface and ground water supplies, and to assist in meeting the future water requirements of the state, and

WHEREAS, policy CO-6 of countywide planning policies states that aggressive conservation efforts shall be implemented to address the need for adequate supply for water resources, including water reuse and reclamation, and

WHEREAS, policy CO-7 of countywide planning policies states that water reuse shall be encouraged for high water users such as parks and golf courses, and

WHEREAS, policy CO-8 of countywide planning policies states that when planning for future demand on wastewater treatment and conveyance, alternatives such as reuse shall be incorporated into plans as viable options, and

WHEREAS, policy TPP-8 of the King County adopted regional wastewater services plan ("RWSP") states that the county shall continue water reuse and explore opportunities for expanded use at existing plants, and shall explore water reuse opportunities at all new treatment facilities, and

WHEREAS, policy WRP-1 of the RWSP directs the county to actively pursue the use of reclaimed water and to accelerate the development of a water reuse program to help meet the goals of the county to preserve water supplies, and

WHEREAS, policy WRP-3 of the RWSP states that reclaimed water shall be investigated as a possible significant new source of water to enhance or maintain fish runs and provide additional water for the region's nonpotable needs, and

WHEREAS, policy TPP-7 of the RWSP directs King County to explore the possibility of constructing one or more satellite treatment plants in order to produce reclaimed water, and

WHEREAS, policy WRP-2 of the RWSP directs the King County executive to prepare a water reuse work plan that includes a list of potential pilot projects and associated costs and to submit that work plan to the council within twelve months, and

WHEREAS, policy WRP-13 of the RWSP directs the King County executive to continue to fund the demonstration projects from the wastewater utility rate base, and

WHEREAS, the King County executive provided the reuse work plan to the King County council in December 2000 that identified the Sammamish valley reclaimed water facility as the selected satellite treatment plant to be constructed to produce reclaimed water to maintain fish runs, provide additional water for non-potable needs for large water users including agriculture and recreation and also provided a budget using the utility rate base, and

WHEREAS, the King County executive aggressively undertook the development of the Sammamish facility on a fast track in order to accelerate the development of reclaimed water to preserve water supplies during drought and to maintain fish runs of endangered species, and

WHEREAS, the King County executive determined that providing reclaimed water to the Sammamish valley from the Brightwater facility using existing infrastructure would provide much larger volumes of reclaimed water at a lower cost and would provide greater environmental benefits to the river by substituting reclaimed water for river water, and

WHEREAS, the King County executive determined that an interim reclaimed water demonstration facility would provide many of the benefits of the original facility at a lower cost with the potential of being used at other locations in the future and provide a training facility for King County operations and maintenance staff in membrane treatment technology, and

WHEREAS, the King County council in the 2004 Budget Ordinance, Ordinance 14797, provided that a report describing the proposed interim facility, the plan for providing reclaimed water to the Sammamish valley from the Brightwater plant and the

life-to-date projects costs, such report to be approved by motion of the council in order to authorize the expenditure of the six million dollars appropriation for wastewater CIP project 423528, and

WHEREAS, the King County executive has provided the report requested by the council along with a proposed base budget for the interim reclaimed water demonstration facility and the executive has directed the King County department of natural resources and parks to evaluate alternative delivery methods in order to determine if lower costs can be achieved, and

WHEREAS, the King County executive will have provided the results of the evaluation of alternative delivery methods to the council by December 2004;

NOW, THEREFORE, BE IT MOVED by the Council of King County:

1. The Proviso Report for the King County Council – Sammamish Reclaimed Water Project, dated April 2004 is hereby approved.

2. The executive is directed to complete an evaluation of alternative delivery methods for the Sammamish valley reclaimed demonstration facility that could reduce capital costs for the project. By December 31, 2004, the executive shall submit to the council a report identifying and evaluating the cost savings associated with each

alternative delivery method considered for the Sammamish valley reclaimed demonstration facility.

Motion 11930 was introduced on 4/26/2004 and passed by the Metropolitan King County Council on 6/1/2004, by the following vote:

Yes: 10 - Mr. Phillips, Ms. Edmonds, Mr. von Reichbauer, Ms. Lambert, Mr. Pelz, Mr. Ferguson, Mr. Hammond, Mr. Gossett, Ms. Hague and Mr. Irons
No: 0
Excused: 3 - Mr. McKenna, Ms. Patterson and Mr. Constantine

KING COUNTY COUNCIL
KING COUNTY, WASHINGTON

Larry Phillips, Chair

ATTEST:

Anne Noris, Clerk of the Council

Attachments A. Proviso Report for King County Council - Sammamish Reclaimed Water Project - April 2004

Attachment A

11930

2004-203

Proviso Report

for King County Council

Sammamish Reclaimed Water Project

April 2004

King County
Department of
Natural Resources and Parks
Wastewater Treatment
Division

For questions or comments, contact:
Tom Fox
King Street Center
201 S. Jackson
Seattle, WA 98104-3856
206-296-5279 TTY Relay 711
tom.fox@metrokc.gov

Alternative Formats Available
206 684-1280 TTY Relay: 711

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Introduction

The King County Council included a budget proviso in the 2004 Budget for Wastewater CIP Project 423528, Sammamish Valley Reclaimed Water Production Facility. The proviso limited the expenditure of the $6 million appropriation for this project to $1 million until the Department of Natural Resources and Parks has submitted a report to the Council and the Council approved the report by motion. The purpose of this report is to provide Council life-to-date project expenditures for the Sammamish Valley Reclaimed Water Production Facility and outline a revised scope and preliminary budget for an interim satellite reclaimed water project in the Sammamish Valley. In addition, the report demonstrates how the approach for the interim reclaimed water facility in the Sammamish Valley is consistent with adopted goals and policies in the Regional Wastewater Services Plan.

The report demonstrates how the interim project will be related to and integrated with reclaimed water production capacity anticipated from the Brightwater Treatment Plant. As the Sammamish project has evolved, one of the most significant developments has been the decision to use the latest treatment technology at the Brightwater Treatment Plant to produce high quality reclaimed water. This decision and the availability of existing conveyance and storage facilities near the Route 9 site allow for delivery of reclaimed water to the Sammamish Valley. The potential is that as much as 10 million gallons per day (mgd) of reclaimed water can be delivered to the Valley for less than the original 1.5 mgd project, estimated to cost $35.1 million. More to the point, the total cost of the conveyance lines to connect to the Brightwater system plus the original project life-to-date costs plus the interim demonstration facility are estimated to be less than the original project estimate ($35.1 million). The significant increase in reclaimed water for the Valley will result in more water left in the river to benefit fish habitat, improve farming and recreational open space opportunities and lower cost of operating parks facilities.

1.0 Project Background

In 1999, the King County Council adopted the Regional Wastewater Services Plan (RWSP) policies, including the following to guide the development of reclaimed water.

> *WRP-3: Recycling and reusing reclaimed water shall be investigated as a possible significant new source of water to enhance or maintain fish runs, supply additional water for the region's nonpotable uses, preserve environmental and aesthetic values and defer the need to develop new potable water supply projects.*

In the same year, the King County Department of Natural Resources and Parks (KCDNRP) established the multi-stakeholder Reclaimed Water Task Force (Task Force) to build on the work of the Water Reuse Policy Development Task Force and to carry out the policies set out in the RWSP. The 1999 stakeholder Task Force was convened by KCDNRP to ensure that strategy development and implementation were carried out in consultation with interested parties, including KCDNRP's regional partners, the state, water and sewer agencies, and others. This stakeholder Task Force was initiated to directly respond to several RWSP policies including "(WRP-2) ...preparation of a list of potential projects and coordination with tribal and local governments, the state and area citizens." The recommendations of the Task Force along with the RWSP policies were used to guide the development of the reuse work program.

As directed by King County RWSP Policies "(TPP-7) ...to explore the possibility of constructing one or more satellite treatment plants...; (WRP-1)...to actively pursue and to accelerate the development of a water reuse program... and (WRP-2)...to prepare a reuse work plan for council review...", KCDNRP developed a list of potential demonstration projects by identifying and ranking potential reclaimed water demands and users throughout King County. The result of these activities was a list of potential projects that define the Demonstration Phase of the Reclaimed Water Program. The potential demonstration projects include satellite treatment plants and direct non-potable uses for reclaimed water. The development of evaluation and selection process used in the Demonstration Phase included the involvement and participation by participating regional partners (purveyors, local and state governments and environmental groups) and is consistent with the Reuse Policies identified in the RWSP.

In 1999 KCDNRP developed a database of potential opportunities to use reclaimed water near large sewer interceptors that currently convey more than 3.0 million gallons per day (mgd) average annual flows. In direct response to RWSP policy WRP-5, the stakeholders and in 2000 KCDNRP developed a process to identify and rank potential water reuse projects that would meet the goals of the Demonstration Phase. The process was titled "Request for Project Nominations (RFN)." The RFN process involved sending out questionnaires to interested parties to gather information on water use and water rights to determine the potential for using reclaimed water in appropriate non-potable applications. To analyze the responses to the RFN, KCDNRP developed evaluation criteria to screen potential application sites. KCDNRP then identified the most likely areas capable of supporting a satellite demonstration plant. The areas with the highest concentration of potential reclaimed water uses in close proximity to a wastewater source were considered to have the highest potential.

The Sammamish River Project ranked highest based on the evaluation and ranking. The Sammamish River Project was included as the satellite facility project submitted to the council in December, 2000. A detailed discussion of the evaluation process and the resultant recommendations is contained in the *Summary Report—Reclaimed Water Program Demonstration Phase—Identification of Potential Satellite Projects for Direct Non-Potable Uses* (Dec 2000).

Consequently, plans were developed for the Sammamish Valley Reclaimed Water Production Demonstration Facility. The facility was planned to produce approximately 1.5 million gallons of reclaimed water throughout the summer irrigation season to irrigate nearby farms and recreational venues. The facility was projected to cost approximately $35.1 million. The benefits of reclaimed water in the Sammamish Valley include the following:

- Provides an alternative water source for the Sammamish Valley agricultural and recreational open space users,
- Enhances the environment for salmon and other wildlife by keeping more water in the Sammamish River,
- Helps preserve the rural character of the valley by providing water for farms and open space recreation,
- Demonstrates the value of reclaimed water to the public,

- Demonstrates new technologies that will allow reclaimed water to be used in areas without regional wastewater plants.

For the original Sammamish Valley Production Facility, a site selection process was followed with extensive public involvement and the participation of the City of Redmond. Permit applications were filed with the City of Redmond and presentations were made to the public and the Redmond officials. A State Environmental Policy Act (SEPA) determination of non-significance was issued for the project and selected site. Design and permit activities were nearly complete. All of this activity cost approximately $4.3 million.

As the project permits were nearing approval and design was nearing completion, concerns were raised about possible conflicts with other parkland users and the overall project costs. In order to deal with these obstacles and concerns, KCDNRP looked at other options to meet the project objectives. The additional review revealed that obtaining reclaimed water from the Brightwater Project, if the Route 9 site was ultimately selected, would be less expensive and have fewer environmental impacts if existing facilities (storage and pipelines) could be converted for use as the conveyance system for delivery of reclaimed water to the Sammamish Valley. In early fall 2003, KCDNRP was exploring the use of a treatment process (membrane biological reactors, MBR) at Brightwater. This treatment process would enable the County to more cost-effectively deliver reclaimed water from Brightwater in quantities sufficient to meet the potential demands for the entire Sammamish Valley, if the Executive selected the preferred Route 9 alternative.

However, since Brightwater will not be online until 2010, the delivery of reclaimed water from the Route 9 site to the Sammamish Valley is not possible in the near term. An interim facility was identified as the alternative for the Sammamish Valley to begin production of reclaimed water by 2007. In addition, KCDNRP will develop the specific plan for the delivery of reclaimed water from Brightwater to the Sammamish Valley and will complete additional SEPA review if necessary when the specific plans are complete.

Using reclaimed water from Brightwater and existing conveyance lines will result in significantly more water being delivered to the Sammamish Valley for less than the original estimated cost of the 1.5 mgd satellite plant.

2.0 Proposed Interim Satellite Project

2.1 Description of proposed project

As a result of the change in direction of the Sammamish Valley Water Reuse Project, revised project objectives and key factors for siting have been developed to satisfy these changed conditions.

2.1.1 Project Objectives

- Produce approximately 0.5 mgd of reclaimed water to reduce some of the environmental impacts of withdrawing water from the Sammamish River.
- Demonstrate King County's continued commitment to reclaimed water in the Sammamish Valley and illustrate its value to the public and future customers

- Develop a training and demonstration facility for membrane treatment technology (the membrane biological reactor technology is proposed for Brightwater)
- Design, permit, construct and have the facility operational in the shortest reasonable timeframe with a target operational date for the 2007 irrigation season.
- Design the project as a temporary facility, anticipating that Brightwater will be the future long-term source of reclaimed water for the Sammamish Valley.
- Build, as economically as possible, a temporary facility that would allow use of the facility up to and a few years beyond 2010, if deemed necessary by the County.
- Develop the treatment facility such that portions or all of the facility can be used in other locations at the conclusion of the demonstration project.
- Design the facility to protect public health and meet regulatory requirements.
- Avoid or minimize impacts to the natural environment.
- Provide appropriate mitigation for the facility, within the limits of the project budget and with due consideration of the temporary nature of the facility. Mitigation would be provided to reduce potential impacts to the community, such as noise, visual, odor and traffic effects, and maintain compatibility with surrounding land uses.
- Maximize the public's investment by maximizing the use of existing county facilities and properties.

2.1.2 Key Factors for Siting

- A minimum of 1.5 acres of area
- Ease and speed of permits
- Extent of wetlands/geotechnical concerns
- Compatibility with neighborhood or ability to mitigate the facility within the budget limits
- Proximity to wastewater source and potential customers
- Availability and proximity of necessary utilities
- Cost implications of the potential sites
- Unincorporated King County-owned land

2.1.3 Project Benefits

A scaled-down reclaimed water demonstration project in the Sammamish Valley will provide many of the original intended benefits. An alternative source of water will be made available to the Valley agricultural and recreational users that demonstrates new treatment technologies. These technologies, when used at other regional or satellite facilities will make reclaimed water available in other parts of the county in the future.

The MBR treatment process is emerging as the most significant advance in wastewater treatment technology in decades. The process can produce a higher quality effluent on a smaller footprint and at lower costs. The technology has been selected for the Brightwater facility. The MBRs require some experience and training to achieve the greatest benefit from the new technology. KCDNRP does not currently have an operational treatment facility utilizing the MBR process. The Interim Facility will be the first for KCDNRP and will represent an opportunity to serve as a training and test facility for staff to gain experience. The Interim Facility will allow existing KCDNRP operations and maintenance staff to have the opportunity to gain valuable experience operating, maintaining, and controlling the membrane biological technology.

The ultimate plan for the Sammamish Valley would be to provide sufficient water from the Brightwater plant for the entire irrigation needs of the major current users in the Valley. As much as 10 mgd of reclaimed water can be delivered from Brightwater which will allow greater volumes of water to remain in the river for fish and wildlife and insure that water will be available to preserve fish habitat and farming in the Valley. The use of reclaimed water will reduce diversions providing a net increase in water in the Sammamish Valley and the Sammamish River. The restored flows could result in as much as a 50 percent increase in the lowest historic low flow condition. This would clearly be a benefit to the summer Chinook salmon run that has been listed as a threatened species as well as other salmon and fish species that use the Sammamish River and related water bodies. Additionally, having an adequate, inexpensive reclaimed water supply is a critical factor in keeping agricultural viable, thus preserving open space and the rural character of the Valley.

2.1.4 Location

Four potential sites have been extensively investigated for the initial project (see Figure 1, Technical Memorandum). These sites and their attributes are described in the attached technical memorandum. A fifth possibility of locating the scaled-down facility on the Willows Run Golf Course was explored. The conclusion was that there is not sufficient space available on the Willows golf course because a significant portion of any existing open space on the course is wetland.

At the conclusion of the site review 60 Acres North – Northeast is recommended as the preferred site for development of the reclaimed water facility.

The selected location best meets the key selection criteria:

- As desired, the site is on property owned by King County and in King County
- There are wetlands in the immediate area but there is sufficient open space to locate a 1.5 acre facility
- There are opportunities to effectively screen the project to make it compatible with the neighborhood
- It is close to wastewater source and customers
- Utilities are in the area.

2.1.5 Potential Customers

There are a variety of potential customers for reclaimed water in the Sammamish Valley, including recreation interests, agriculture and a golf course. KCDNRP has been working closely with Willows Run Golf Course and the Lake Washington Youth Soccer Association as potential users of the reclaimed water from the demonstration project.

The Willows Run Golf Course is currently purchasing water from King County and using a temporary King County water right for Sammamish River water. This water right authorizes Willows Run Golf Course to use approximately 0.5 MGD of water from the Sammamish River. The temporary water right Willows Run Golf Course is using runs through May 2005. King County also has a contract with Willows Run Golf Course to use reclaimed water when reclaimed water is available to the Valley in sufficient quantities.

The Lake Washington Youth Soccer Association currently operates approximately 16 athletic fields at the Sixty Acres North location and is seeking to work out a transaction with the County that would facilitate an additional 10 – 12 grass athletic fields at Sixty Acres south. The Soccer Association irrigates these fields using water drawn out of the Sammamish River. The water is withdrawn from the river using a King County owned water right.

As identified in section 2.1.4 the proposed location for the demonstration project is the County-owned Sixty Acres North site. Given this location, the costs to serve the athletic fields operated by the Lake Washington Youth Soccer Association are less than those associated with supplying the water to the Golf Course due to reduced need for pipe infrastructure to carry the reclaimed water from the plant to the site. Therefore KCDNRP proposes to use the water from the Demonstration project to irrigate the athletic fields at Sixty Acres North and any fields developed at Sixty Acres South. The use of reclaimed water for athletic field irrigation will replace 0.5 mgd of water diverted from the Sammamish River. The use will be from April through October. From November to April the proposed demonstration facility would be shut down.

KCDNRP will also seek an extension to the temporary water rights permit for Willows Run Golf Course until reclaimed water is available from Brightwater. This will enable the Willows Run Golf Course to continue to irrigate its land. At such time that the Brightwater Plant is online reclaimed water would then be available to the Golf Course in whatever quantities are needed.

2.1.6 Relationship to Regional Water Supply Planning

One of the County's goals is to ensure that regional water supply planning meets Growth Management Act and Endangered Species Act goals. One of the means to achieve this goal is to include reclaimed water in the regional water supply. A specific goal of the reclaimed water program is to use reclaimed water to assist the region to balance water resource needs of the environment and people.

The role of the wastewater treatment facility owner (King County) is defined in RCW 90.46.120:

> *If the proposed use or uses of reclaimed water are intended to augment or replace potable water supplies or create the potential for the development of additional potable water supplies, such use or uses shall be considered in the development of the regional water supply plan or plans addressing potable water supply service by multiple water purveyors. The owner of a wastewater treatment facility that proposes to reclaim water shall be included as a participant in the development of such regional water supply plan or plans.*

Reclaimed water can be used as a water supply source to further these goals by replacing potable water use and by replacing water that is being diverted from streams and groundwater. As plans are developed to bring reclaimed water from Brightwater, KCDNRP will consult and coordinate with regional water suppliers to ensure that water reuse decisions are consistent with regional water supply plans. Reclaimed water can be used to improve stream flow and stream quality by reducing water use thereby benefiting the environment. For every gallon of water reused, a gallon of water is not diverted from a stream or aquifer, a gallon of treated water is not discharged to the environment and a gallon of water is used beneficially.

2.1.7 Reusable elements from previous project

The satellite demonstration facility located at the 60 Acres North Site will allow the use of the original wetlands delineation, some of the conveyance piping design (survey, analysis, soil borings) and some of the information developed for the SEPA documents. A new SEPA threshold determination and new permit application materials will be required, however a significant portion of the previous work can be used to guide the development and preparation of these materials.

2.2 Schedule and Action Items

As currently planned the interim facility design will be developed sufficiently to allow the evaluation of alternative delivery methods, described in Section 2.3 below. A final schedule and cost estimate will be developed using the results of the alternative delivery analysis and will be provided to the Council by December 2004. These analyses will be accomplished within the existing expenditure authority. For planning and evaluation purposes, the schedule is shown in Table 1. The project goal for the schedule is to begin delivery of reclaimed water by the 2007 irrigation season.

Table 1:
Sammamish Valley Reclaimed Water Facility
Project Schedule

Activity	Time Frame
Preliminary Design	April 2004 – June 2004
30% Design	July 2004 – Oct 2004
Public Information	Summer 2004 thru Construction
SEPA Comment Period	Nov 2004 – Dec 2004
Permitting	Oct 2004 – Oct 2005
60% Design	Nov 2004 – Mar 2005
Final Design	July 2005 – Oct 2005
Advertise/Award	Nov 2005 – Apr 2006
Construction	May 2006 – Apr 2007
Startup	May 2007 – Jun 2007

2.3 Current Costs and Budget Estimates

KCDNRP has prepared preliminary cost estimates and a project scope for the new demonstration project. Preliminary estimates for the new project are shown below in Table 2. These costs include project design, permitting and construction. The estimated project budget to serve the athletic fields at Sixty Acres is approximately $9.6 million. KCDNRP staff are aware of recent proposals from the private sector indicating that alternative delivery methods could reduce the project costs. The Department will rigorously investigate whether such opportunities exist. KCDNRP is proposing to take the time to research the scopes and budgets of new plants recently completed and confirm whether there may be cost savings that can be achieved. KCDNRP is also proposing that the project cost estimates in Table 2 below be used as a baseline against which it will evaluate potential cost savings. KCNDRP will explore every opportunity to reduce costs, including alternative project delivery and procurement methods. KCDNRP can complete this work within the existing $1M budget authority. KCDNRP will not expend any funds

beyond the already authorized $1 million until it has completed the analysis to determine whether any project savings can be found and Council has approved the report.

Table 2:
Proposed Budget for Interim Sammamish Valley Reclaimed Water Facility

Description	Total
Site Work	$868,000
Influent Pumping Station	$400,000
Influent Screen Building	$442,000
Odor Control	$460,000
Treatment Facility	$3,340,000
Construction Subtotal	$5,510,000
Sales Tax (8.8% of Construction)	$485,000
Project Contingency (20% of Construction)	$1,102,000
Construction Contingency (10% of Construction)	$551,000
Allied Costs (35% of Construction)	$1,929,000
TOTAL	$9,577,000
PROPOSED BUDGET AMOUNT	**$9,600,000**

At the time the decision was made to consider providing water from the Brightwater facility and to construct the Interim Facility, the estimated cost to complete the 1.5 mgd original plant was $35,100,000. The potential to provide reclaimed water from the Brightwater Facility using existing facilities could result in ***five times*** as much reclaimed water to the Sammamish Valley at a lower total cost.

3.0 Relationship to Brightwater

As described by the Brightwater Final EIS, the Brightwater Treatment Plant, to be located at the Route 9 site will produce high quality reclaimed water for onsite demand. The initial production is expected to serve needs on the treatment plant site, including landscape irrigation and process water. KCDNRP identified potential customers for reclaimed water within five miles of both treatment plant site alternatives and within five miles of the Route 9 effluent corridor including the Sammamish Valley. KCDNRP evaluated the feasibility of providing these potential customers with reclaimed water.

As the market demand for reclaimed water increases, the Brightwater Treatment Plant can provide increasing amounts of reclaimed water in the future. During the design of Brightwater, the county will incorporate when and how to provide the conveyance capacity to deliver reclaimed water from the Brightwater Treatment Plant in the most cost-effective manner.

Any future decision to provide reclaimed water offsite would be subject to appropriate economic, engineering and environmental review.

4.0 Sammamish Valley Project Accrued Costs to Date

Following the initial site selection process, design was undertaken to apply for permits. Work was conducted and expenditures were made for design, permitting, environmental, public involvement and administration. This work was conducted by both County staff and by an engineering consultant team for the 1999 through 2003 period.

Construction	$50,692	(pilot project)
Engineering Contracts	$3,591,589	(consultants for design)
Other costs	$189,274	(advertising, legal fees, etc.)
Permits and right of way	$36,541	(permit fees, appraisals, consultants)
Staff labor	$470,936	(management, permits, environmental)
Total	$4,339,032	

5.0 Attachments

5.1 Technical Memorandum
5.2 Regional Wastewater Services Plan Policy Comparison

King County
Department of Natural Resources and Parks

Sammamish Valley
Interim Reclaimed Water Production Facility

TECHNICAL MEMORANDUM
60-ACRES EAST INTERIM FACILITY SITE AND CONFIGURATION EVALUATION

FINAL DRAFT
February 2004

CAROLLO engineers

1218 THIRD AVENUE, SUITE 1600 • SEATTLE, WASHINGTON 98101-3032 • (206) 684-6532 • FAX (206) 903-0419

KING COUNTY
DEPARTMENT OF NATURAL RESOURCES AND PARKS

SAMMAMISH VALLEY
INTERIM RECLAIMED WATER PRODUCTION FACILITY

TECHNICAL MEMORANDUM
60-ACRES EAST INTERIM FACILITY
SITE AND CONFIGURATION EVALUATION

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1.0 INTRODUCTION

1.1 Background and Purpose

The King County Department of Natural Resources and Parks (KCDNRP) has recognized that reclaimed water could serve as a significant new source of water to meet the needs of both the environment and people. The original Sammamish Valley RWPF was proposed for construction on 60-Acres South (east of the Sammamish River and south of NE 116th Street). The proposed facility would have had an initial reclaimed water production capacity of 1.5 million gallons per day (mgd). Future demand of up to 5.0 mgd and stringent treatment requirements for groundwater recharge were incorporated into the master plan for the RWPF.

The project was planned as a model for the implementation of reclaimed water. Specifically, the goals of the RWPF included:

- Providing a reliable, drought resistant water supply for customers.
- Enhancing fish runs by providing an alternative source of irrigation water.
- Demonstrating the safety and environmental benefits of reclaimed water.
- Constructing an economically and ecologically sustainable reclamation facility.
- Identifying and meeting the needs of the communities.

Carollo Engineers recommended a Membrane Bio-Reactor (MBR) to reliably produce effluent better than the Class A requirements. The MBR process consists of biological treatment in an activated sludge process and membrane separation of reclaimed water from the activated sludge. The site configuration at that proposed facilty was a "campus type" configuration consisting of a number of smaller buildings in keeping with the rural nature of the valley. The total project cost estimate for the original Sammamish Valley RWPF was approximately $30 million.

There were delays in the permitting process for the original project and King County decided to consider an interim facility with a capacity of 0.5 mgd.

The purpose of this technical memorandum is to summarize the Sammamish Valley Interim Reclaimed Water Production Facility (RWPF) scope, schedule and budget. The interim facility would provide reclaimed water until Brightwater, the County's regional facility currently being planned, is operational. The development of the interim facility included a review of some of the sites that had previously been considered for the original Sammamish Valley RWPF. In addition to the goals of the original facility, the goals for the interim facility include:

- Reducing project costs.

- Accelerating the design/permitting/construction schedule to have the facility on-line as soon as possible. The goal for completing construction is May 2007.
- Demonstrating the viability of reclaimed water as a resource.
- Interim Facility Design Guidelines

1.1.1 Interim Facility Configuration

The facility configuration would need to be constructed on the reduced site footprint while complying with regulatory constraints. The potential configuration is based on identification and development of cost saving measures to determine a base treatment facility with a maximum production capacity of 0.5 mgd.

In general, the base treatment facility configuration reduces the overall land requirements and project costs with limited mitigation measures. Specifically, the modified facility reflects the following key features:

- A compressed single building approach versus the original "campus" style multiple building layout.
- A maximum, ultimate production capacity of 0.5 mgd.
- Limited mitigation measures.
- To minimize total costs and scheduling time, a "package" membrane bio-reactor treatment system would be supplied by a vendor. The system would include pretreatment, aeration basin tanks and a membrane system.
- Appropriate odor control will be provided to meet the County's odor control requirements, however, the base cost was developed without odor control to facilitate comparison to previous estimates. Additional costs were developed separately for the provision of single-stage and two-stage odor treatment.
- Minimum site improvements (i.e. gravel roadway).
- The reclaimed water customer is assumed to be 60-Acres North and South based on direction from King County.
- Costs were developed to provide conveyance to Willows Run Golf Course as an alternate customer per direction from King County.

1.2 Design Criteria

Table 1 highlights process areas and some key components and assumptions applied in the 0.5 mgd interim facility configuration. Key components planned for the original 60-Acres South site are also provided for comparison.

Table 1	Design Criteria, Design Intent, and Mitigation Measures Sammamish Valley Interim Reclaimed Water Production Facility King County Department of Natural Resources and Parks	
	Interim Treatment Facility	**Planned at 60-Acres South**
General	• Maximum, ultimate capacity of 0.5 mgd • Compressed single building approach • Low cost structure	• Maximum initial capacity of 1.5 mgd. Ultimate capacity of 5.0 mgd • "Campus" style multiple building layout • LEED sustainable architectural design with recycled cedar siding to fit the rural nature of the valley
Collection System Interface	• Submersible pump station without odor control • No bioxide addition	• Self-cleaning wetwell with point source odor control • Bioxide addition to interceptor
Headworks	• Maximum capacity of 0.5 mgd	• Initial capacity of 3.5 mgd, expandable to 5.0 mgd
Aeration Basin	• 0.5 mgd aeration basins with single aerobic zone • Prefabricated steel tank structures	• 10 zone basin with capabilities for step feed and future bio-P removal • Capability to split the basin into two trains • Sustainable "green roof" for stormwater management and aesthetics • Below grade for aesthetics
Membrane Tanks	• 0.5 mgd membrane tank capacity • Prefabricated steel tank structures • 2 trains with reduced capacity during clean-in-place	• 1.5 mgd membrane capacity, membrane tanks expandable to 3.5 mgd • Enclosed treatment process with removable treadplate covers • Below grade for aesthetics • 4 trains with 33% increase in flux during clean-in-place
Reverse Osmosis*	• No accommodations for future reverse osmosis planned	• Accommodations for future reverse osmosis facilities
Odor Control	• Base case - no odor control • Single stage odor control with chemical scrubbers likely required to meet King County requirements • Second stage compost filter for additional odor treatment optional.	• Three-stage odor control with bioscrubbers, chemical scrubbers and biofilters • Point source odor control at the influent pump station, headworks, aeration basin and membrane tanks
Chemical Room/ Disinfection	• No bioxide system • Centrally located chemical area with sodium hypochlorite, sodium hydroxide and citric acid • UV disinfection	• Bioxide for odor control in the interceptor • UV disinfection • Separate chemical (sodium hypochlorite and sodium hydroxide) storage and metering area odor control facilities
Electrical Room	• Single, centrally located electrical room	• Electrical room at each building
Miscellaneous Facilities	• Plant drained to interceptor by gravity • Gravel surfacing for roadway and parking lot. • No public areas	• Plant drained to interceptor by gravity • Pervious pavement in public areas • Public facilities including restrooms, storage area and gardens
*For groundwater recharge		

2.0 SITE SELECTION

2.1 Sites Considered

Four sites were initially considered for the interim facility. These were identified as:

- 60-Acres South (original site considered)
- 60-Acres East (to the east of the existing soccer fields)
- 60-Acres North (In northwest corner of parking lot for soccer fields, adjacent to the Sammamish River.)
- York Site (On the south side of NE 124th Street, east of Willows Road and directly across the street from King County's York Pump Station.

These site locations are shown on Figure 1. A meeting was held on February 4, 2004 with King County staff to review the possible site alternatives. The sites were compared for issues including possible permitting constraints, possible public issues, the ability to use previous permit work and the ability to use previous engineering work. These factors are summarized in Table 2.

The 60-Acres South site (the original site) was eliminated because of potential permitting issues associated with the City of Redmond. The 60-Acres North site was eliminated because it may be located on wetlands and is adjacent to the Sammamish River and the Sammamish River Trail. The York site was eliminated because of wetlands issues, a historic barn located on the site and additional property acquisition challenges (King County does not currently own that property). The 60-Acres East site was selected as the preferred site for the interim facility evaluation.

2.2 Site Evaluation

Figure 2 shows a site plan of the Interim RWPF at the 60-Acre East Site. Access to the site would be via a 600-foot roadway from NE 116th Street. Although a significant portion of the property has wetlands, the proposed layout was configured to minimize impacts to these wetlands. An area on the west side of the property and at the middle of the western boundary is without wetlands. The preliminary site plan was completed to provide adequate area for the facility, balance cut and fill and not encroach on the surrounding wetland areas. Based on this preliminary layout, the only wetland area that impacted is limited to approximately 1500 square feet along the proposed access road.

Table 2 Interim Facility Alternative Site Comparison
Sammamish Valley Interim Reclaimed Water Production Facility
King County Department of Natural Resources and Parks

Alternative	Description	Cost	Schedule	Permit Issues	Public Issues	Ability to use previous permit work	Ability to use previous engineering work
Baseline conditions	0.5 mgd Reuse Plant	$8M	Available for 2007 Irrigation Season	Permits must be obtained within schedule	Coordinate with neighbors		
60-Acres South	South of 60-Acres (original site)	+ 15% (1)	Available for 2007 Irrigation Season	City of Redmond permits required	Previous park users opposition	Est. 90% can be reused.	P&IDs, control work, mapping
60-Acres East	East of 60-Acres (Northeast of original site)	+ 10% (2)	Available for 2007 Irrigation Season (5)	"Marbled" wetlands on site have been delineated.	5-6 neighbors very close	Est. 50% (wetland delin.) can be reused. SEPA checklist, PAUE, other permit applic's will be new.	P&IDs, control work
60-Acres North	Northwest corner of soccer field in parking lot	+ 15% (3)	Available for 2008 Irrigation Season (5)	Possible wetlands; wetland recon at soccer fields completed.	Close to soccer fields and trail	Est. 25% can be reused (wetland recon. at soccer fields). SEPA checklist, PAUE, other permit applic's will be new.	P&IDs, control work
York	Southeast corner of Willows Road and NE 124th Street	+ 30% (4)	Available for 2008 Irrigation Season (5)	Wetlands have been delineated.	"historic" barn	Est. 50% (wetland delin.) can be reused. SEPA checklist, PAUE, other permit applic's will be new.	P&IDs, control work

(1) Approximately 2500 lineal feet of waterline and PRV station required for fire protection and 5% allowance for possible use of pile footings.
(2) Approximately 1000 lineal feet of waterline required for fire protection and 5% allowance for geotechnical unknowns.
(3) Approximately 2500 lineal feet of waterline and PRV station required for fire protection and 5% allowance for geotechnical unknowns.
(4) May require restoration of barn and will require longer conveyance lines to supply reclamation plant and to convey reclaimed water.
(5) Wetlands permitting may delay project completion until this date.

3.0 ASSESSMENT OF THE SELECTED SITE

3.1 Permitting Evaluation

The interim RWPF project, including construction and operation of the facility and conveyance piping at the 60-Acres East Site, was reviewed for permit compliance. Listed in Table 3 are the anticipated federal, state, and local permit requirements and regulations that may be required for the construction and operation of a reclaimed water production facility in the Sammamish Valley. The interim RWPF and associated conveyance pipelines would be located within unincorporated King County. As shown in Figure 2, the access road would impact approximately 1,500 square feet of wetland on the site.

If a conveyance pipeline were provided to serve the Willows Run Golf Course, this would result in pipeline construction in the City of Redmond. As noted in Table 3, permits from the City of Redmond would only apply to the Willows Run Golf Course conveyance pipeline.

Table 3 60-Acres East Site - Permitting Requirements
Sammamish Valley Interim Reclaimed Water Production Facility
King County Department of Natural Resources and Parks

Permit	Regulated Activity	Permit Review Timeline	Suggested Submittal Schedule	Permit considerations and Issues	Agency Contact Name, Phone Number
Federal					
US Army Corps of Engineers (COE) – Section 404 Nationwide 39 Permit	NW 39 –Discharge of fill material for the construction or expansion or residential, commercial, or institutional building foundations and attendant structures.	Nationwide Permit (45 to 60 days) Note: recent experience suggests longer review cycles.	After alternatives description prepared and construction method selected.	• Public Notification (30 days). • Included in JARPA. Because wetland impact is approximately 0.03-acre post-construction notification is required. Preparation of a Biological Assessment (described below) will likely still be required.	Sandra Manning (Ecology) (360) 407-6912 COE: Regulatory Section (206) 764-3495
National Marine Fisheries Service (NOAA Fisheries) – Section 7 ESA Consultation **US Fish and Wildlife Service (USFWS) –** Section 7 ESA Consultation	Section 7 of the ESA requires all federal agencies to insure that any actions they authorize are not likely to jeopardize a listed species or adversely modify its critical habitat. If a permit is required from COE, they must consult with NMFS/USFWS.	Up to 120 days after submittal to COE, plus up to 180 days after submittal to NMFS and/or USFWS (300 days total, or longer).	After construction details are finalized. Typically requires specific construction detail for BA/BEs under Section 7.	• A Federal nexus exists where projects require work on federally controlled properties, work requiring federally issued permits (i.e.,COE Section 10 and 404), and/or projects that will use federal funding.	NOAA Fisheries and USFWS
State					
Ecology – Federal Water Pollution Control National Pollutant Discharge Elimination System (NPDES) Act 402 WAC 173-220 33 USC 1344 RCW 90.48.260	Construction activities, including clearing, grading, and excavation, that disturb one or more acres of land.	Between 30 and 180 days depending on the complexity of the project.	After site details are known (e.g., disturbance area, staging and access areas); at least 30 days prior to start of construction.	• Stormwater Pollution Prevention Plan. • Public notification.	Bill Moore (Ecology) (360) 407-6444 (assigned by region)
Washington Department of Fish and Wildlife Hydraulic Project Approval RCW 77.55.100	Using, diverting, obstructing, or changing the natural flow or bed of a water of the state	Up to 45 days	Submitted as part of JARPA at least 60 days prior to anticipated start of construction.	• May be required for construction dewatering discharge	*Eric Pentico* (WDFW) (425) 379-2305

Table 3 60-Acres East Site - Permitting Requirements
Sammamish Valley Interim Reclaimed Water Production Facility
King County Department of Natural Resources and Parks

Permit	Regulated Activity	Permit Review Timeline	Suggested Submittal Schedule	Permit considerations and Issues	Agency Contact Name, Phone Number
Local – King County					
King County Wastewater Treatment Division – SEPA Threshold Determination WAC 197-11		17 days	New SEPA Checklist necessary for proposed site.	• To determine if project will have significant adverse environmental impacts and as a result require a SEPA EIS.	Steve Tolzman (206) 263-6185 (King County)
King County – Shoreline Substantial Development Permit WAC 173-14	Activities within 200 feet of streams and river segments with a mean annual flow >20 cubic ft./sec., *and* associated wetlands	28-day waiting period; maximum 120-day review (concurrent)	Submit at least 120 days prior to anticipated start of construction.	• Public hearing • Included in JARPA	Mark Mitchell (206) 296-7119 (King County)
King County DDES– Public Agency Utility Exception K.C.C. 21A.24	Required to allow an exception to wetland and stream protections included in King County Code, including impacts to buffers.	Variable		• Requires alternative analysis, including alternate locations, alternatives, design methodologies and mitigation opportunities.	Laura Casey (King County DDES)
King County DDES – Sensitive Areas Review Local Regulations (K.C.C. 21A.24.100)	Alteration of a site which impacts a sensitive area or is within an identified sensitive area buffer.	Variable		• May be required to submit a critical areas study. • May be required to develop mitigation and monitoring plans.	Laura Casey (King County DDES)
King County DDES – Clearing/Grading Permit	Required for grading around sensitive area; threshold< 100 cubic feet.	90 days		• Need excavation volumes.	(King County DDES)
King County DDES – Street Use Permit	Construction activities all or partly within the county right-of-way.		Reviewed as part of clearing and grading permit.		(King County DDES)
King County Department of Natural Resources (King Co. DNR) – Industrial Waste Discharge Local Regulations (K.C.C. 28.84.060)	Construction dewatering discharge.	30 days		• Must meet discharge standards and limitations. • Need discharge volumes and water quality information.	KCDNR

Table 4 Additional Permitting Requirements for Conveyance Line to Willows Run Golf Course Sammamish Valley Interim Reclaimed Water Production Facility King County Department of Natural Resources and Parks

Permit	Regulated Activity	Permit Review Timeline	Suggested Submittal Schedule	Permit Considerations and Issues	Agency Contact Name, Phone Number
Local – City of Redmond					
City of Redmond Clearing/Grading Permit	Required if 50 cubic yards or more are moved (either filled or removed).	45 to 90 days	Concurrent with King County Clearing and Grading Permit	• Need excavation volumes	Geoffrey Thomas (425) 556-2445 City of Redmond
City of Redmond Shoreline Substantial Development Permit	Required to build on or within 200 feet of any lake, river or stream and whose improvement value exceeds $2500 and is consistent with Redmond's Sensitive Area Ordinance.	120 days		• Shorelines include: Sammamish River and all assoc. bogs, swamps, and river deltas.	Geoffrey Thomas (425) 556-2445 City of Redmond
City of Redmond Flood Control Zone Permit	Construction and other activities that cause disturbance within sensitive areas.	Concurrent with other City permits		• A sensitive area report must be submitted to the City.	Geoffrey Thomas (425) 556-2445 City of Redmond
City of Redmond Street Use Permit	Construction activities all or partly within the city right-of-way.				Geoffrey Thomas (425) 556-2445 City of Redmond

3.2 SEPA Compliance

King County Department of Natural Resources and Parks prepared a SEPA Environmental Checklist in accordance with WAC 197-11 for the originally proposed facility at 60-Acres South. The checklist found the proposal was not likely to have a significant adverse impact, and a Determination of Non-Significance (DNS) was issued on November 8, 2002 (refer to the SEPA Checklist for further details). A new SEPA Environmental Checklist will be needed for the interim treatment facility. Where possible all relevant studies used to prepare the Environmental Checklist for the originally proposed facility at 60-Acres South will be used. It is anticipated that a DNS will be issued for the new facility as the environmental conditions and impacts are likely to be similar to the original proposal.

3.3 Wetlands

Adolfson Associates Inc. (Adolfson) conducted an investigation to identify and delineate wetlands on the four alternative site locations for the interim reclaimed water production facility. The field investigations were conducted between June 2002 and March 2003.

The proposed interim RWPF site (60-Acres East) is located on the east side of the Sammamish River and on the north side of NE 116th Street, immediately east of the 60-Acres soccer fields. Described below is a summary of the wetlands investigations conducted on this site (refer to the August 8, 2002 Sammamish Reclaimed Water Production Facility Wetland Memorandum for further detail).

The purpose of the site investigation was to identify and delineate wetlands on the site proposed for the interim RWPF. Methods defined in the *Washington State Wetlands Identification and Delineation Manual* (Washington State Department of Ecology, 1997), a manual consistent with the *Corps of Engineers Wetlands Delineation Manual* ("1987 Manual") (Environmental Laboratory, 1987) were used to determine the presence and extent of wetlands on the subject property. Washington State and all local governments must use the state delineation manual to implement the Shoreline Management Act (SMA) and/or the local regulations adopted pursuant to the Growth Management Act (GMA). The methodology outlined in the manual is based upon three essential characteristics of wetlands: (1) hydrophilic vegetation; (2) hydric soils; and (3) wetland hydrology. Field indicators of these three characteristics must all be present in order to make a positive wetland determination (unless problem areas or atypical situations are encountered).

The site is bordered on the south by NE 116th Street and on the east by 154th Place NE. The eastern one-third of the site is occupied by a hill that slopes west towards the soccer fields. The base of the hill occurs near the middle of the site, and the site flattens toward the west. The site is completely vegetated, and is dominated by a mixture of grasses, herbs and upland shrubs. Trees including red alder (FAC) and black cottonwood (FACW), as well

as Himalayan blackberry (FACU), occupy the extreme eastern and western edges of the site.

Two palustrine emergent wetlands, Wetlands A and B, were delineated as shown on Figure 2. The three wetland parameters described above were satisfied at each of these two wetlands. Both wetlands appear to be supported by groundwater flowing from springs or seeps located near the top of the slope in the eastern third of the site. The wetland areas contained dark-colored, hydric soils that were saturated to the surface at the time of the June 2002 site investigation. Soil saturation in June is notable because many other areas that qualify as jurisdictional wetland in western Washington have already dried out by early June.

Wetland A covers approximately 5.9 acres and is dominated by reed canary grass (FACW) and soft rush (FACW). Wetland B covers approximately 0.06 acre and is dominated by soft rush.

Areas on site that were not identified as wetlands supported tall fescue (FAC-), tall buttercup (FACW-), Himalayan blackberry (FACU), and Scot's broom (NL). The non-wetland areas typically contained dry, light-colored soils.

Wetland A would be considered a Class 2 wetland according to King County Code (KCC) 21A.06.1415 because it is greater than one acre in size. KCC 21A.24.320 requires a 50-foot wide upland buffer to be maintained around Class 2 wetlands. Wetland B would be considered a Class 3 wetland because it covers less than one acre and contains only one vegetation class. Under KCC 21A.24.320 a 25-foot wide vegetated upland buffer is required to be maintained around Class 3 wetlands.

In addition to DDES, the US Army Corps of Engineers (Corps) regulates the discharge of dredged or fill materials into waters of the US (including wetlands) under sections 404 and 401 of the Clean Water Act. Any wetland fill on the site would require a permit from the Corps; the type of permit would vary depending upon the extent of fill area. A Nationwide 39 permit is granted by the Corps for wetland fill of less than 0.5 acre associated with residential, commercial, and institutional developments. Should the fill be 0.5 acre or greater, an Individual permit would be required by the Corps. The Nationwide permit process is comparatively less complicated than the Individual permit process and does not require an alternatives analysis as part of the process. Mitigation will be required for all wetland impact areas. The timeframe estimated for the Nationwide permit is 9 to 12 months.

The need to obtain a federal permit would also trigger compliance with the Endangered Species Act (ESA). Preparation of a Biological Assessment (BA) and "consultation" with the federal agencies that administer the ESA would be necessary. The BA process can take 9 to 15 months in general, and can occur in parallel with the Corps permitting process. Completion of the ESA process is required before the Corps will issue a permit.

The Sammamish River, located west of the site, is considered a Class 1 stream according to criteria outlined in the Redmond Community Development Guide (RCDG) 20D.140.10-070. RCDG 20.D.140.10-100 requires a 150-foot wide upland buffer to be maintained around Class 1 streams.

3.4 Land Use/Zoning

The property is currently zoned A-10, agricultural land with a minimum lot size of 10 acres, and is 5- to 10-acres of open space on an approximately 15 percent slope. The site proposed for the treatment facilities is approximately 1,200 ft east of the Sammamish River and the North Lake Sammamish Interceptor (see Figure 1). The adjacent land is currently used for recreational purposes (soccer). However, the land proposed for the treatment facilities is on a slope and is not currently used for recreational purposes.

3.5 Geotechnical Information

The proposed site is not located in the floodplain (King County GIS Mapping), however initial review of geotechnical data indicate potential presence of seismically sensitive soils and high groundwater levels.

The proposed site is located near the original proposed site (60-Acres South). A detailed geotechnical investigation was conducted on the 60-Acres South site (Shannon & Wilson, 2003) that showed 6 to 10 feet of alluviam and organic peaty silt on top of a silt and clay layer. The general recommendations of this geotechnical report are that the project site is underlain by about 6 to 10 feet of soft, compressible organic soils. For the conceptual design, the building structure would be a pre-engineered steel building and would be constructed on a concrete mat foundation slab. If design proceeds at this location, further soils investigations and evaluations will have to be completed to finalize the structural design criteria.

4.0 POTENTIAL FACILITY CONFIGURATIONS

Figure 2 shows a conceptual site plan for the interim facility that was developed to minimize the potential impact to wetlands based on available mapping and the wetlands delineation.

The project site is located in unincorporated King County, but lies within the City of Redmond Fire Department Service Area Boundary. Therefore, the City of Redmond Fire Department provides fire protection for this area. The site plan provides for a 22-foot wide fire lane to the facility with a turn-around area on the north side of the site. It is our understanding that since all areas of the building would be accessible to a standard fire hose, driving access around the entire perimeter of the facility is not required. This should be confirmed with the appropriate regulatory officials.

4.1 Collection System Interface

The collection system interface would be on the north side of NE 116th Street, immediately east of the Sammamish River. The concept is similar to that proposed for the original 60-Acres South site where raw sewage would be diverted from the North Lake Sammamish Interceptor.

The collection system interface would include a submersible pump station (RWPF Influent Pump Station) located in the southwest corner of the 60-Acres soccer field's parking lot. To minimize costs and construction requirements, caisson type construction is proposed for the wet well. The soil conditions should be favorable for this type of construction. The Hollywood Pump Station which is located adjacent to the Sammamish River and approximately one half mile to the north of this location was constructed via the same methods. The interim RWPF pump station would be much smaller than the Hollywood Pump Station and would predominately be located underground and enclosed (except the control panel). The approximate depth from the ground surface to the normal operating surface of the wetwell would be approximately 25 feet. The pump station would be provided with two submersible pumps, each with a capacity of 0.5 mgd and would have a firm pumping capacity of 0.5 mgd (with one pump out of service).

Wastewater diverted from the interceptor will be pumped approximately 1,200 lineal feet to the east and then approximately 600 lineal feet north to the Influent Screening Building. Waste flows (WAS, grit, drains, etc.) from the interim RWPF will flow by gravity back to the North Lake Sammamish Interceptor in a new gravity sewer. This new sewer will discharge to the North Lake Sammamish Interceptor downstream of the new RWPF Influent Pump Station.

The pipelines between the North Lake Sammamish Interceptor and interim reclaimed water treatment facility are assumed to be installed below the existing gravel parking lot for the 60-Acres soccer fields and the new access road to the influent screening building.

4.2 Influent Screening Building

As recommended in Technical Memorandum No. 6 - Collection System Interface - of the Conceptual Design Report (Carollo Engineers, December 2002), headworks screening is recommended based on construction cost, operation and maintenance, and reliability. The proposed package treatment system includes a mechanical screen for fine screening (2 mm).

For the conceptual design, the screening equipment is proposed to be located in a separate structure, immediately to the south of the Treatment Building. The equipment is similar to that proposed for the 60-Acres South site, but is oriented in a linear arrangement to minimize space requirements and fit within the site constraints.

In addition to the screening equipment, a screenings washer/compactor could be provided. The bagged screenings would then be disposed of as solid waste. The drain from the washer/compactor returns the liquid waste to the influent of the headworks to retain organic matter for the biological treatment processes.

Another option would be to not provide the compactor and to sluice the screenings back to the North Lake Sammamish Interceptor in the new return sewer line.

4.3 Treatment Building

Figure 3 provides a plan view of the Treatment Building. The Treatment Building, located to the north of the Influent Screening Building, includes membranes and associated equipment and disinfection facilities. The Treatment Building also includes blowers, pumps, chemical storage and metering equipment, electrical infrastructure and operations facilities for the interim RWPF. To reduce total project costs, the aeration basins would not be located within the treatment building. These would be located adjacent to the treatment Building and cost have been included to provide a roof structure over these basins. The purpose of this structure is primarily to for visual screening of the aeration basins from the property owners to the east. Space has also been provided in the covered aeration basin area to permit addition of odor control equipment.

Preliminary process sizing information for the MBR system has been included in Appendix A.

4.3.1 Aeration Basins

The aeration basins are sized to treat 0.5 mgd. Basin redundancy, step feed aeration and biological phosphorous removal capabilities are not included in the layout of the aeration basins. These features provide the ability to meet additional or future treatment requirements (i.e., groundwater injection), but require additional space, equipment and capital investment.

An aeration basin capacity of approximately 100,000 gallons is required for 0.5 mgd of treatment capacity. This results in two basins approximately 12 feet wide by 55 feet long with a normal side water depth of 10 feet. Alkalinity control would be provided with anoxic zones or chemical addition. Recycled activated sludge (RAS) is pumped to the head of the basin from the membrane tanks. Mixed liquor flows by gravity from the downstream end of the aeration basin to the membrane tanks.

4.3.2 Membrane Tanks and Associated Equipment

Two membrane tanks provide 0.5-mgd of treatment capacity. The capacity of the membrane tanks is approximately 17,000 gallons for 0.5 mgd of treatment capacity. Each basin is approximately 9 feet wide by 14 feet long with a normal side water depth of 9.5 feet (Based on Preliminary Design calculations provided by Jet Tech Products, February, 2004.

Equipment for other potential suppliers are expected to be similar, but will result in slightly different dimensions and configurations.).

Support equipment for the membranes includes filtration pumps, recirculation pumps, clean-in-place (CIP) equipment and backwash equipment. Three filtration pumps, including 1 spare, are required to filter water through the membranes. Three recirculation pumps (1 spare) pump mixed liquor from the membrane tanks to the head of the aeration basins. The CIP system includes a 12-foot diameter, 8,000-gallon storage tank and small end-suction centrifugal pump. The backwash system includes a 6-foot diameter, 2,000-gallon storage tank and two end-suction centrifugal pumps.

4.3.3 Disinfection Facilities

Options considered for disinfection included chlorination with sodium hypochlorite and UV disinfection. To provide the contact time for chlorination additional sodium hypochlorite storage and metering pumps would be required., Preliminary cost estimates for UV disinfection equipment were in the range of approximately $200,000. This is similar to the costs anticipated to provide chlorination system. A UV system will provide the additional benefits of lower operating costs and reduced chemical deliveries.

UV disinfection was selected and will be provided with an open channel UV disinfection system. The 0.5 MGD system design criteria would be based on National Water Research Institute (NWRI) guidelines and include a UV dose of 80 mJ/cm^2. The UV transmittance (UVT) is approximately 60 percent based on previous testing, but should be confirmed for equipment sizing. Three modules for peak flow treatment and 1 additional module to meet NWRI redundancy requirements are assumed. The UV modules would be housed in an above grade stainless steel tank with an A-frame lifting device for removal.

4.3.4 Odor Treatment

Appropriate odor control will be provided to meet the County's odor control requirements, however, the base cost was developed without odor control to facilitate comparison to previous estimates. Additional costs were developed separately for the provision of single-stage and two-stage odor treatment.

Several options are available for odor control depending on the treatment requirements.

The initial option would be for single-stage odor control with a chemical scrubber for treatment of the air. This could be supplied as a packaged chemical scrubber. The packaged scrubber would include recirculation pumps, exhaust fan, instrumentation and other accessories. The aeration basins and membrane bioreactors would be covered and 12 air changes per hour would be provided for the head space in these tanks. Odor treatment would also be provided for the Influent Screening Building.

If a higher level of odor treatment is necessary, the treated air from the scrubber would be provided with a second level of biological treatment via a compost scrubber. This would be located to the north of the parking area and the treatment building..

4.3.5 Blower Area

The blower area provides space for three aeration blowers, two membrane blowers and one air compressor/receiver. The blowers are assumed to be rotary, positive displacement type with one spare for the aeration system and one spare for the membrane system. Due to the noise of positive displacement blowers, significant noise control measures are required for this room including acoustical louvers.

4.3.6 Mechanical/HVAC Room

The mechanical/HVAC room provides space for building mechanical equipment such as a water heater and HVAC equipment.

4.3.7 Chemical Area

The chemical area contains storage and metering equipment for sodium hypochlorite, citric acid and sodium hydroxide (caustic).

Sodium hypochlorite is an optional primary disinfectant. In addition, sodium hypochlorite is required for membrane cleaning, odor control at the chemical scrubber(s), algae control and possibly waste activated sludge inactivation. One 5,800-gallon storage tank is planned to accept delivery of full truckloads and facilitate the delivery scheduling process. Redundant diaphragm metering pumps are planned for disinfection (if used as the primary disinfectant) and odor control, which are critical services. One hose pump for each of the other services is planned since these services are not critical and/or are infrequently used.

Citric acid is required for membrane cleaning. One 300-gallon tote bin is planned with one hose pump for membrane backpulse and one hose pump for membrane clean-in-place.

Sodium hydroxide is required for odor control at the chemical scrubber(s). Two 300-gallon tote bins with two diaphragm metering pumps are planned. One metering pump operates in standby to provide redundancy for this service.

4.3.8 Electrical Room

Figures 3 shows a preliminary location of the electrical room. The room is approximately 20 feet by 40 feet and includes space for switchgear, MCCs, VFDs, and panelboards for all of the interim RWPF equipment except the influent pump station. Electrical equipment required for the influent pump station would be located near the pump station. The main Puget Sound Energy transformer would be located outside of the Treatment Building.

4.4 Finished Water Storage

Depending on the reclaimed water customer(s), finished water storage may be necessary to maximize the use of the reclaimed water and meet the customers demands. The final storage volume depends on the customer demands and irrigation schedule. Currently, the soccer fields do not have any available storage.

5.0 CONSTRUCTION COST ESTIMATE

A construction cost estimate was developed and is included in Appendix B. A summary of the probable construction cost is provided in Table 5.

This is a conceptual level design cost estimate. The estimating accuracy at this level can often range from -10% to plus 25%. The range is a function of the unknowns, i.e. geotechnical information. Based on the equipment cost information already obtained and the relative risk in estimating the other project components, an estimating contingency of 15% was applied to the construction cost as well as a sales tax rate of 8.8%.

Table 5	Probable Construction Cost Summary for Conceptual Design Sammamish Valley Interim Reclaimed Water Production Facility King County Department of Natural Resources and Parks	
	Description	**Total**
Site Work (including fire supply and influent, reuse and drain lines)		$868,000
Influent Pumping Station		$400,000
Influent Screen Building		$442,000
Treatment Facility		$3,340,000
	Subtotal	$5,050,000
	Estimating contingency (15%)	$758,000
	Subtotal	$5,808,000
	Sales Tax (8.8%)	$511,000
DIRECT CONSTRUCTION COST		$6,319,000
ALLIED COSTS (30%)		$1,896,000
TOTAL BASE PROJECT COST		**$8,215,000**
Single Stage Odor Treatment System (Including indirect project costs)		$813,000
TOTAL BASE PROJECT COST WITH SINGLE STAGE ODOR TREATMENT		**$9,028,000**
OPTIONAL ITEMS (including indirect project costs)		
	6000 LF 8-inch supply line to Willows Run Golf Course	$634,000
	Additional second-stage odor treatment	$651,000

6.0 PROJECT SCHEDULE

This section summarizes the project milestones and delivery issues for the Sammamish Valley Interim RWPF at the 60-East site. The project delivery date and expected design and construction schedule are listed in Table 6.

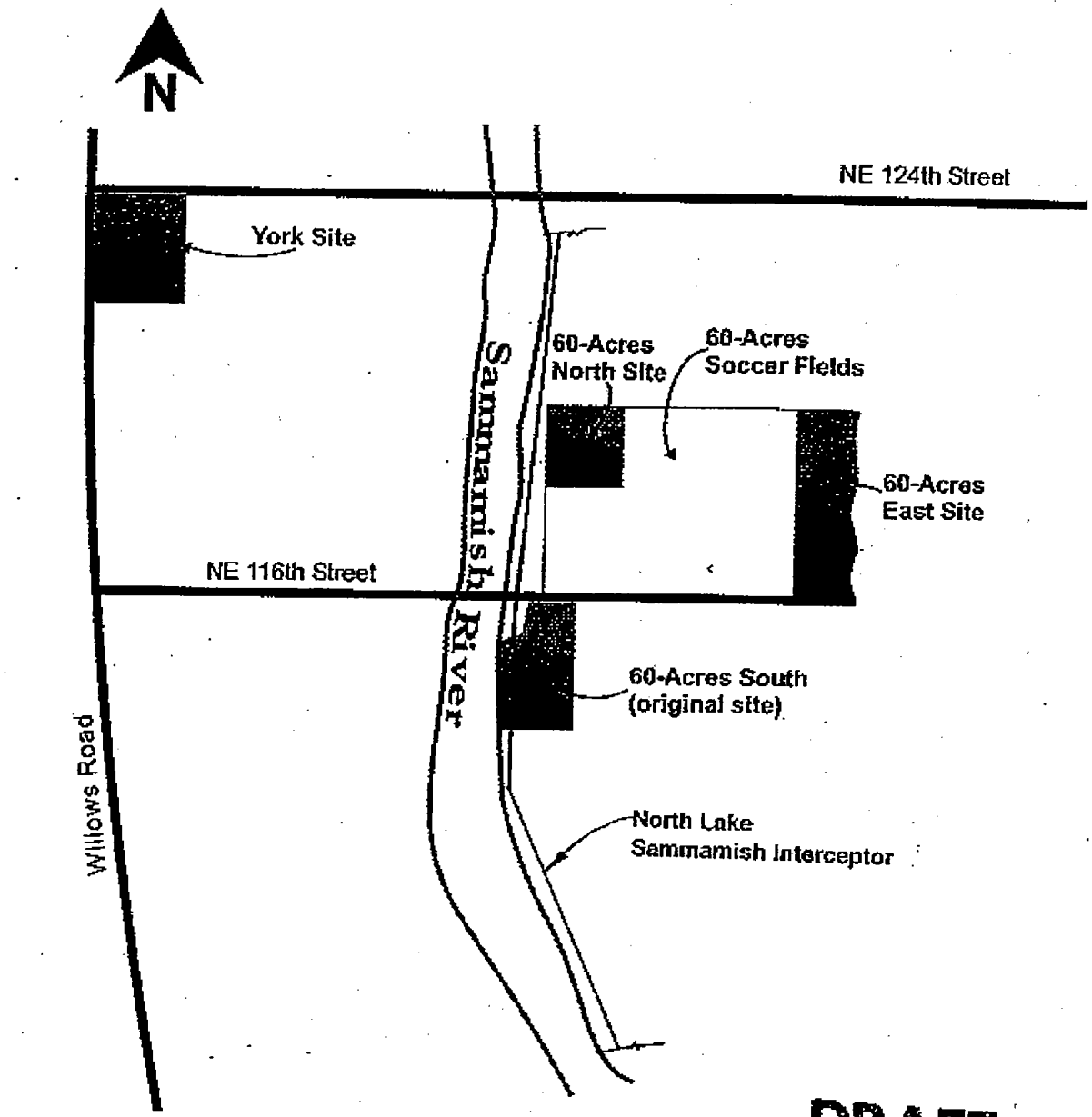
Table 6 Project Delivery Milestones and Schedule
Sammamish Valley Interim Reclaimed Water Production Facility
King County Department of Natural Resources and Parks

Project Milestones	Approximate Schedule
Public Involvement	Jun. 2004 - Jun. 2007
Preliminary Design	April 2004 – June 2004
30% Design	July 2004 – Oct. 2004
Permitting*	Oct. 2004 - Oct. 2005
60% Design	Nov. 2004 - Mar. 2005
Final Design	July 2005 - Oct. 2005
Advertise and Award	Nov. 2005 - Apr.- 2006
Construction	May 2006 – Apr. 2007
Startup	May - 2007 - Jun. 2007

*An allowance of 12 months included based on uncertainties of processing time for NOAA Fisheries concurrence.

The project schedule is defined by environmental permitting and review activities as presented above. The date of project completion and delivery of reclaimed water to the customers is also impacted by design, bidding, fabrication, delivery and installation of major equipment.

Operation of the facility for the 2007 irrigation season appears possible, but this will depend on the actual time requirements of the permitting process.



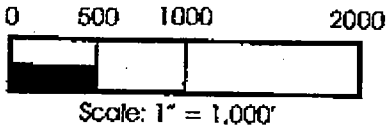


FIGURE 1
SAMMAMISH VALLEY INTERIM
RECLAIMED WATER PRODUCTION FACILITY
ALTERNATIVE SITE LOCATIONS

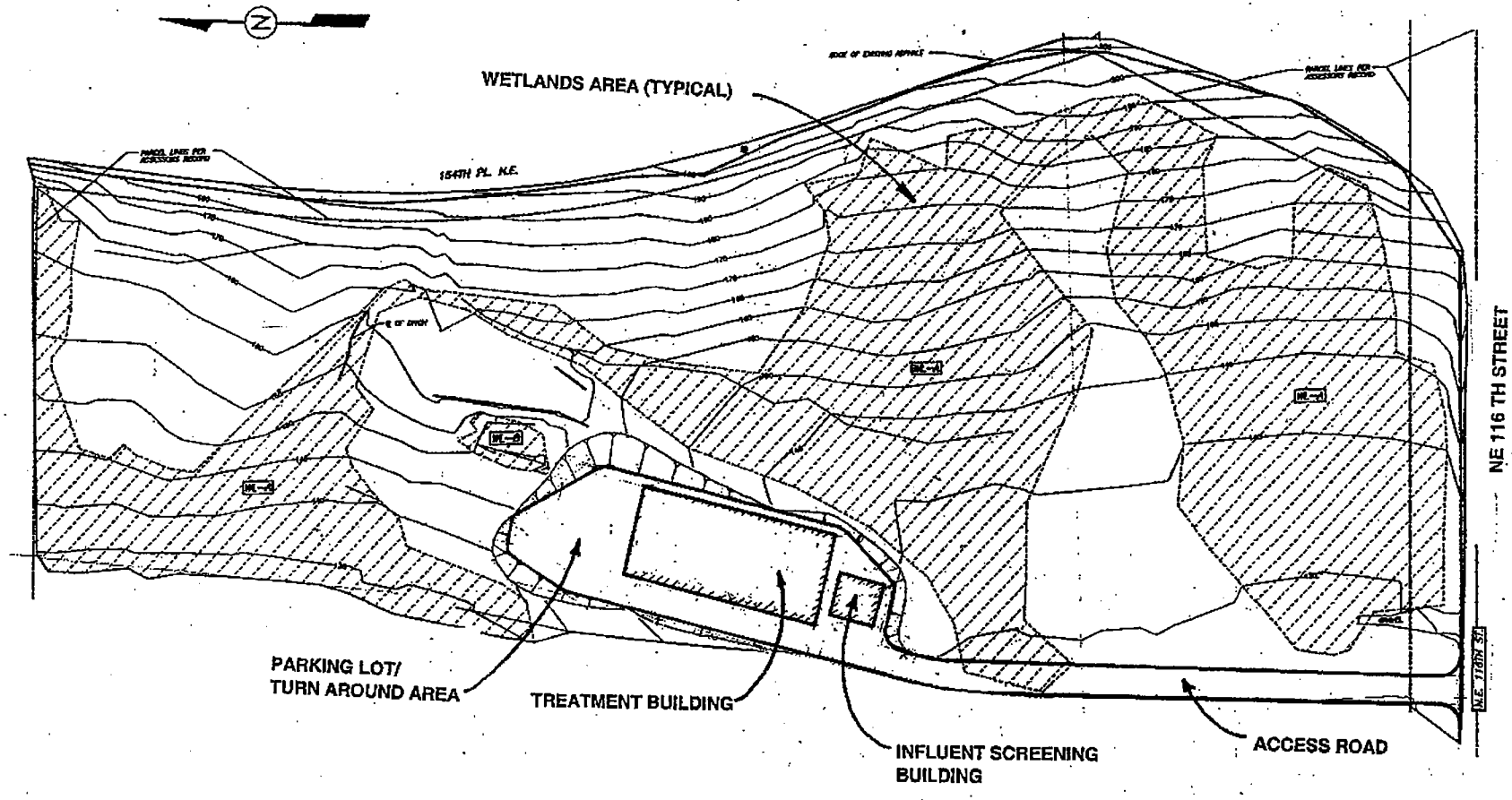


FIGURE 2
SAMMAMISH VALLEY INTERIM
RECLAIMED WATER PRODUCTION FACILITY
60-ACRES EAST SITE PLAN

SCALE: 1" = 100'

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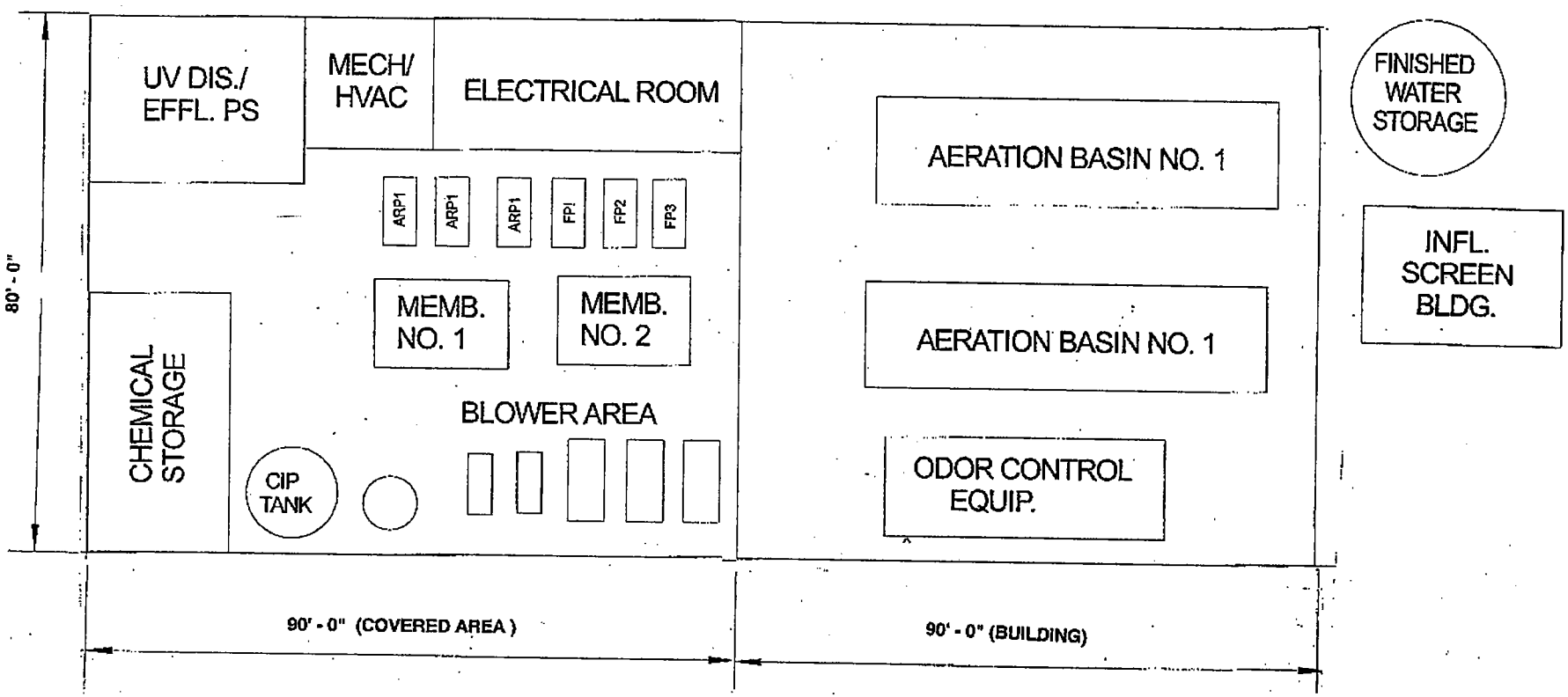

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FIGURE 3
SAMMAMISH VALLEY INTERIM
RECLAIMED WATER PRODUCTION FACILITY
60-ACRES EAST
TREATMENT FACILITY PLAN

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APPENDIX A

MBR PROCESS INFORMATION

USFilter

Prep. by: MJK
Rev. No. 0
Date: 2/9/2004

King County, WA - Sammamish Package Plant

JET TECH PRODUCTS MEMBRANE BIOREACTOR
DESIGN CALCULATIONS
PRELIMINARY DESIGN

JET TECH PRODUCTS FILE NO. MBP-04

Typical MBR

I. DESIGN PARAMETERS:

Influent & Effluent Characteristics			English Units	
Average Daily Flow	=	0.50	MGD average	1,893 m3/d
Peak Daily Flow	=	0.50	MGD daily peak*	1,893 m3/d
Peak Hourly Flow	=	0.50	MGD hourly peak*	1,893 m3/d
Influent COD	=	400	mg/l total*	
	=	1,668	lbs./day	756 kg/d
	=	176	mg/l soluble	
Effluent COD	<		mg/l	
	=		***not required***	
COD removed	=	1,585	lbs./day	719 kg/d
Peak sustained COD load	=	600	mg/l, for not more than	
		6	consecutive days	
Influent BOD	=	200	mg/l	
	=	834	lbs./day	378 kg/d
Effluent CBOD	<	5	mg/l	
	=	*5*	***mg/l required***	
BOD removed	=	813	lbs./day	369 kg/d
Influent TSS	=	200	mg/l	
	=	834	lbs./day	378 kg/d
Influent VSS fraction	=	80	% *	
Effluent TSS	<	5	mg/l	
	=	*5*	***mg/l required***	
	=	21	lbs./day	9 kg/d
Influent Dissolved Solids, TDS	=	500	mg/l*	
Influent NH4-N	=	27	mg/l	
	=	111	lbs./day	50 kg/d
Influent TKN	=	40	mg/l*	
	=	167	lbs./day	76 kg/d
Effluent NH3-N	<	1.0	mg/l	
	=	*1.0*	***mg/l required***	
			Assumed standard uninhibited nitrification rate*	
Effluent Total Nitrogen	<		mg/l	
	=		***not required***	

King County, WA - Sammamish Package Plant	Typical MBR	2/9/2004

Influent Phosphorus	=	6	mg/l*		
	=	24	lbs./day	11 kg/d	
Effluent Phosphorus	<		mg/l		
	=		*not required*		
Winter Temperature (min)	=	54 °F *		12 °C *	
Summer Temperature (max)	=	77 °F *		25 °C *	
Elevation	=	500	ft. MSL*	152 m	
Average Barometric Pressure	=	14.43	psia	99 kPa	0.99 bar

II. FEED SYSTEM DESIGN

Equalization Basin

Hydr. Retention Time, HRT at Average Flow	=	0.0	h	
Equalization Volume	=	0.00	MG	0 m3

Transfer Pump

No. of Transfer Pumps	=	1		
Pump Design Flow	=	347	gpm/Pump	79 m3/h/Pump

III. MEMBRANE OPERATING SYSTEM:

Membrane Modules

Flow for Membrane System	=	0.50	MGD	1,893 m3/d
No. of Membrane Tanks	=	2		
Type of Module Used	=	B10R		
Membrane Material	=	PVdF		
Length of Module	=	4.9	ft.	1.50 m
Design Inst. Flow per Mod.	=	1.10	gpm at 20 C	250 l/h/mod
No. of Modules Required	=	**480**	**modules**	
No. of Modules per Rack	=	40		
Total No. of Racks	=	12	racks	
No. of Racks/Memb. Tank	=	**6**	**racks/memb. tank**	
Backwash Flow Factor	=	1.08		
Inst. Flow per Module	=	0.78	gpm at Winter Temp.	178 l/h/mod

Membrane Tank

Number of Membrane Tanks	=	2		
Length	=	13.5	ft. (rack length)	4.12 m
Width	=	8.6	ft.	2.62 m
Maximum Water Level	=	9.3	ft.	2.83 m
Tank Height at High Point of Sloped Floor	=	13.3	ft.	4.05 m
Tank Height at Low Point of Sloped Floor	=	13.8	ft.	4.21 m
Freeboard above overflow	=	4	ft.	1.22 m
Membrane Tank Liquid Vol.	=	8,300	gal/Tank	31.5 m3/Tank
Membrane Tank Volume (inc. freeboard)	=	**11,780**	**gal/Tank**	**44.6 m3/Tank**

CIP Tank

CIP Liquid Vol. Required	=	8,300	gal	31.5 m3
Number of CIP Tanks	=	1		
Maximum Water Level	=	10.0	ft.	3.05 m
Freeboard above overflow	=	3	ft.	0.91 m
Required Diameter	=	11.9	ft.	3.62 m
Liquid volume per Tank	=	8,300	gal	31.5 m3
CIP Tank Volume	=	**8,633**	**gal**	**32.7 m3**

King County, WA - Sammamish Package Plant	Typical MBR	2/9/2004

Backwash Tank

BW Liquid Vol. Req'd	=	1,980	gal	7.5 m3
Number of BW Tanks	=	1		
Maximum Water Level	=	10.0	ft.	3.05 m
Freeboard above overflow	=	1	ft.	0.30 m
Required Diameter	=	5.8	ft.	1.77 m
Volume per Tank	=	1,980	gal	7.5 m3
BW Tank Volume	=	**2,006**	**gal**	**7.6 m3**

Membrane Aeration System

Operating Blowers	=	0.5	per membrane tank		
Type of Blowers :	=	*Rotary Positive Displacement*			
Total Blowers	=	2	total		
Spare Blowers	=	1	spare		
Aeration Frequency	=	100	%		
Air Flow per Blower	=	913	SCFM	1,552 m3/h	
Inlet Losses	=	0.3	psig *	2.07 kPa	0.02 bar
Net Inlet Pressure	=	14.13	psia (absolute)	97.40 kPa	0.97 bar
Discharge Piping Losses	=	0.7	psig *	4.83 kPa	0.05 bar
Static Head + Aerator Loss	=	4.13	psig	28.45 kPa	0.28 bar
Total Discharge Pressure	=	5.13	psig	35.34 kPa	0.35 bar
Design Ambient Temp.	=	100	°F maximum	38 °C	
		0	°F minimum	-18 °C	
Site Air Flow Required	=	1,008	ICFM average	1713 m3/h	
Equiv. Sea Level Pressure	=	5.57	psig average	38.41 kPa	0.38 bar
Nominal Blower Efficiency	=	64	% *		
BHp per Blower	=	30.9	BHp/Blower	23.0 BkW	
				25.6 kW @ 90% ME	
Blower BHp/Membrane Tank	=	15.4	BHp/Tank	11.5 BkW	
				12.8 kW @ 90% ME	

Filtration Pumps

Number of Pumps	=	1	per Membrane Tank		
Type of Pumps :	=	*Self-Priming Centrifugal*			
Total Number of Pumps	=	3	total		
Spare Pumps	=	1	spare		
Full Flow per Pump	=	348	gpm	79 m3/h	
Filtration Flow per Pump	=	188	gpm	43 m3/h	
Required Suction Head	=	21	ft.	6.40 m	
System Headloss	=	4	ft.*	1.22 m	
Total Pump Head	=	25	ft.	7.62 m	
Assumed Pump Efficiency	=	76	% *		
BHp per Pump	=	2.9	BHp/Pump	2.2 BkW	
				2.4 kW @ 90% ME	
Total Pump BHp/Tank	=	2.9	BHp/tank	2.2 BkW	
				2.4 kW @ 90% ME	

Membrane Re-circulation Pumps

Number of Pumps	=	1	per Tank		
Type of Pumps :	=	*Dry Pit Centrifugal*			
Total Number of Pumps	=	3	total		
Spare Pumps	=	1	spare		
Flow per Pump	=	1,200	gpm	273 m3/h	
Required Discharge Head	=	17	ft.	5.18 m	
System Headloss	=	4	ft.*	1.22 m	
Total Pump Head	=	21	ft.	6.40 m	
Assumed Pump Efficiency	=	76	% *		
BHp per Pump	=	8.4	BHp/Pump	6.2 BkW	
				6.9 kW @ 90% ME	
Total Pump BHp/Tank	=	8.4	BHp/tank	6.2 BkW	
				6.9 kW @ 90% ME	

Metering Pumps

Chlorine Metering Pump for Cl	=	168	gph	637 L/h
Chlorine Metering Pump for M	=	33	gph	127 L/h

Citric Acid Metering Pump for (= 522 gph 1,977 L/h

IV. BIOLOGICAL PROCESS DESIGN

Biological Design Parameters

Design MLSS	=	10,000	**mg/l**
MLVSS	=	7,500	mg/L
System SRT	=	14	**days min. SRT**
Biosolids Yield Factor	=	0.23	gVSS/gCODr/d
	=	0.45	gVSS/gBODr/d

Required Biological Reactor Volume and Sludge Yields

Average COD removed	=	1,585	lbs./day	719 kg/d
Maximum COD removed	=	2,419	lbs./day	1,097 kg/d
Avg Biosolids Yield	=	357	lbs./day	162 kg/d
Avg Chemical Sludge	=	0	lbs./day	0 kg/d
Avg. Net Sludge Yield	=	**682**	**lbs/d based on CODr***	**309 kg/d**
(bio + inerts)		**691**	**lbs/d based on BODr***	**313 kg/d**
Maximum Sludge Yield	=	869	lbs/d based on CODr*	394 kg/d
Required Biological Mass	=	9,545	lbs MLSS	4,329 kgs
Total Biological Volume	=	**0.114**	**MG**	**433 m3**
Loading Rate	=	54.5	lb BOD/kcf/day	1.75 kg COD/m3/d
System F:Mv	=	0.116		
System HRT	=	**5.5**	**h**	
Maximum Water Level	=	10.0	ft.	3.05 m

V. ANAEROBIC SYSTEM DESIGN (not utilized)

Anaerobic Basin

No. of Anaerobic Basins	=	0		
Anaerobic HRT	=	1.1	h	
Total Anaerobic Volume	=	0.000	MG	0.0 m3
Anaerobic Volume per Basin	=		MG	m3
Maximum Water Level	=		ft.	m

If Rectangular Basins are used :

Length/Width Ratio	=	1.0	: 1	
Length	=		ft.	m
Width	=		ft.	m

If Round Tanks are used :

Diameter	=		ft.	m

Recycle Anoxic MLSS Pump (RAMLS)

Anaerobic Recycle Ratio	=	2		
Recycle Flow Req'd	=		gpm	m3/h
Pumps per Anoxic Basin	=	1		
Flow per RAMLS Pump	=		gpm/Pump	m3/h/Pump

Anaerobic Mixer

Design Mixing Power	=	1.00	Hp/kcf	kW/m^3
Total Mixing Power Req'd	=		Hp/Basin	kW/Basin
No. of Zones per Basin	=	1		
Mixers per Anaerobic Zone	=	2		
Mixer Intensity	=		Hp/Mixer	kW/Mixer
Design Mixer Intensity	=	3.0	Hp/Mixer	kW/Mixer
Total No. of Mixers	=			
Total Installed Mixer Power	=		Hp	kW

VI. ANOXIC SYSTEM DESIGN (not utilized)

Anoxic Basin

No. of Anoxic Basins	=	0		
NO3-N denitrified	=		lbs/day	kg/d
Specific Utilization Rate for Denitrification (adjusted)	=	0.034	lbsNO3-N/MLVSS/day	0.015 kgNO3-N/MLVSS/day
Total Anoxic Volume	=	**0.000**	**MG**	**0 m3**
Anoxic Volume per Basin	=		MG/Basin	m3/Basin
Anoxic Zone HRT	=	**0.00**	**h**	
Maximum Water Level	=		ft.	m

If Rectangular Basins are used :

Length/Width Ratio	=	1.0	: 1	
Length	=		ft.	**m**
Width	=		ft.	**m**

If Round Tanks are used :

Diameter	=		ft.	m

Recycle MLSS Pump (RMLS)

Anoxic Recycle Ratio	=			
Recycle Flow Req'd	=		gpm	m3/h
Pumps per Aerobic Basin	=	1		
Flow per RMLS Pump	=		gpm/Pump	m3/h/Pump

Anoxic Mixer

Design Mixing Power	=	0.75	Hp/kcf	kW/m3
Total Mixing Power Req'd	=		HP/Basin	kW/Basin
No. of Zones per Basin	=	1		
Mixers per Anoxic Zone	=	1		
Mixing Intensity	=		Hp/Mixer	kW/Mixer
Design Mixer Intensity	=	5.0	Hp/Mixer	kW/Mixer
Total No. of Mixers	=	0.0		
Total Installed Mixer Power	=		Hp	kW

VII. AEROBIC SYSTEM DESIGN

Aeration Basin

No. of Aeration Basins	=	2		
Total Biological Volume Req'd	=	0.114	MG	433 m3
Total Membrane Tank Volume	=	0.017	MG	63 m3
Total Anoxic Tank Volume	=	0.000	MG	0 m3
Total Anaerobic Tank Volume	=	0.000	MG	0 m3
Aeration Basin Volume	=	**0.049**	**MG/Basin**	**185 m3/Basin**
Maximum Water Level	=	10.0	ft.	3.05 m

If Rectangular Basins are used :

Length/Width Ratio	=	0.2	: 1	
Length	=	12.0	ft.	3.66 m
Width	=	54.5	ft.	16.61 m

If Round Tanks are used :

Diameter	=	28.9	ft.	8.80 m

Oxygen Requirement

First Estimate :

lbs. O2/lbs. BOD removed	=	1.40	kg O2/kg BOD removed		
lbs. O2/lbs. TKN oxidized	=	4.6	kg O2/kg TKNoxidized		
lbs. O2/lbs. NO3x denitrified	=	-2.86	Denite efficiency =	80 %	
O2 Supp. by Memb. Re-circ. Flow	=	123	lbs./day		56 kg/d
Actual Oxygen Req'd, AOR	=	1,333	lbs. O2/day		605 kg/d

Second Estimate :

Check AOR estimate against mass balance :
(TKNox may be included in COD, assume not)

AOR = CODi - CODw - CODes + 4.6*TKNox - 2.86*NO3Ndn

where :

CODi = influent	=	1,668 lbs./day	756 kg/d
CODw = wasted	=	428 lbs./day	194 kg/d
CODes = eff soluble	=	83 lbs./day	38 kg/d
TKNox** = oxidized	=	138 lbs./day	62 kg/d
NO3Ndn = denitrified	=	27 lbs./day	12 kg/d
Oxygen supplied by Memb. Re-circulat. Flow	=	123 lbs./day	56 kg/d

The oxygen requirement determined by mass balance is:

AOR = 1,590 lbs./day 721 kg/d

Differences in AOR values calculated is due to assumptions for sludge yield, for effluent COD & BOD, and for oxidation of NH3-N in the COD analysis. Precise determination of AOR requires a detailed plant or pilot study. Use highest value in lieu of better data. Therefore :

DESIGN AOR = 1,590 lbs. O2/day 721 kg/d

Convert Process, or Actual Oxygen Requirement (AOR), to Standard Oxygen (SOR) :

Conversion Formula from ASCE Manual of Practice :

$$SOR = \frac{AOR * Cs}{a * (\beta Csd - DO) * \emptyset^{(T-20)}}$$

Where:

Cs = DO sat'n at Std. Conditions
= 9.07*(1+0.4*D/34)
= 10.1 mg/l

Csd = DO saturation at design conditions
= Cst*(Fe+0.4*D/34)
where : Cst = DO saturation at liquid Temp & 1 sea level
= 8.2 mg/l
Therefore, Csd = 9.0 mg/l

Elev. Factor, Fe = 0.98
Alpha, a = 0.50 *
D.O., mg/l= 2 mg/l
Liquid Temp, T = 25 °C

SWD, D = 10.0 ft
Beta, ß = 0.95 *
Theta, Ø = 1.024

Oxygen Supply Peaking Factor	=	1.1	
Therefore:			
Standard Oxygen Required, SOR	=	**4,780 lbs. O2/day**	**2,168 kg/d**

VIII. AERATION SYSTEM DESIGN:

Type of Aeration System	=	1	*1 = Fine Bubbles* *2 = Coarse Bubbles* *3 = Jets*	
Aerator Elevation	=	1.0		0.30 m
Aerator Submergence	=	9.0	ft.	2.74 m
SOR for Aeration Design	=	100	lbs./hr/basin	45 kg/h

Design Gassing Rate	=	7.0	SCFM/Diffuser	12 m3/h/Diffuser
Site Gassing Rate	=	7.0	ICFM/Diffuser	12 m3/h/Diffuser
Absorption Efficiency	=	14.4	%	
Design Air Flow	=	668	SCFM/basin	1136 m3/h
Diffusers Required per Basin	=	95.4		
Diffuser Grids per Basin	=	1		
Diffusers per Grid	=	96		

IX. BLOWER DESIGN CALCULATIONS:

Operating Blowers	=	1	per Aerating Basin	
Type of Blowers :	=	1	*1 = Rotary, Positive Displacement* *2 = Multistage Centrifugal* *3 = Variable-Vane Centrifugal*	
Total Number of Blowers	=	3	including a spare	
Air Flow per Blower	=	668	SCFM	1,136 m3/h
Inlet Losses	=	0.3	psig *	2.07 kPa 0.02 bar
Net Inlet Pressure	=	14.13	psia (absolute)	97.40 kPa 0.97 bar
Discharge Piping Losses	=	0.7	psig *	4.83 kPa 0.05 bar
Static Head + Aerator Loss	=	4.40	psig average	30.31 kPa 0.30 bar
Total Discharge Pressure	=	5.40	psig average	37.21 kPa 0.37 bar
Design Ambient Temp.	=	100	°F maximum	38 °C
		0	°F minimum	-18 °C
Site Air Flow Required	=	737	ICFM average	1253 m3/h
Equiv. Sea Level Pressure	=	5.87	psig average	40.45 kPa 0.40 bar
Nominal Blower Efficiency	=	64	% *	
BHp per Blower	=	24	BHp/Blower	17.6 BkW 19.6 kW @ 90% ME
Blower BHp/Aerating Basin	=	24	BHp/Basin	17.6 BkW 19.6 kW @ 90% ME

X. PUMP DESIGN CALCULATIONS: (not utilized)

Number of Pumps	=	1	per basin	
Type of Pumps :	=	1	*1 = Dry Pit Centrifugal* *2 = Submersible Centrifugal* *3 = Submersible Propeller*	
Total Number of Pumps	=			
Flow per Pump	=		GPM	m3/h
Required Jet Head	=	17	ft.	m
System Headloss	=		ft.*	m
Total Pump Head	=		ft.	m
Assumed Pump Efficiency	=		% *	
BHp per Pump	=		BHp	BkW kW @ 90% ME
Total Pump BHp/Basin	=		BHp	BkW kW @ 90% ME

XI. PHOSPHORUS REMOVAL

BOD vs Phosphorus :

Assume TSSi inert fraction is as shown under 'DESIGN PARAMETERS'.

Check BOD to P ratios :

Based on total influent values :	Based on soluble influent values :
BODi:P = 35:1	SBODi:P = 17:1

Approximate mg BODi/mg P reqr'd = 29:1 at oxic SRT selected

No Phosphorus Removal

Influent Phosphorus	= 23.8	lbs/day	10.8 kg/day
Phosphorus Removed in Waste Sludge	= 3.6	lbs/day	1.6 kg/day
Phosphorus Effluent Criteria	= 20.3	lbs/day	9.2 kg/day
Chemical Phosphorus Removal Required	= 0.0	lbs/day	0.0 kg/day
	= 0.0	mg/l	
Approximate Alum Dosage Required	= 0 mg/l	(as Al2(SO4)3, 18(H2O))	
	= 0 gpd	@ 49% Al2(SO4)3,	0 l/d
or			
Approximate Ferric Chloride Dosage Reqr'd	= 0 mg/l	(as FeCl3)	
	= 0 gpd	@ 30% FeCl3	0 l/d

XII. ALKALINITY REQUIREMENT CALCULATIONS:

Assume waste biosolids contain 10% N. Also, 7.14 mg/l alkalinity per 1 mg/l nitrate generated and 3.57 mg/l alkalinity recovered per 1 mg/l nitrate denitrified.

Total TKN Oxidized to Nitrate	=	31	mg/l	@ TKNi - (0.10*dXv)	
	or =	131	lbs/d		59 kg/d
Alkalinity Req'd for Nitrification	=	225	mg/l		
Alkalinity Recovered from Denite	=	90	mg/l	80 % *Denitrification Eff.*	
Alkalinity Lost in Process	=	135	mg/l		
Alkalinity Lost from Alum Dosage	=	0	mg/l		
Influent Alkalinity Concentration	=	250	mg/l*		
Alkalinity as Buffer	=	75	mg/l		
Additional Alkalinity Required	=	0	mg/l*		
	or =	0	lbs/d	as CaCO3	kg/d
Chemical Required	=	0	lbs/d	of NaOH	kg/d
	or =	0	lbs/d	of NaHCO3	kg/d

XIII. NUTRIENT REQUIREMENT CALCULATIONS:

Nitrogen : assume a minimum waste biosolids content of 10% Nitrogen,and that a 5 mg/l soluble total N in effluent ensures adequate N for process.

N Addition Required =	0	mg/l	@ (0.10*dXv+5) - TKNi	
or =	0	mg/l	@ (0.05*BODi) - TKNi	
use the greater value =	0	mg/l	of Nitrogen	
or =	0	lbs/d	of Nitrogen	0 kg/d
Chemical Required =	0	lbs/d	of anhyd. ammonia	0 kg/d
or =	0	lbs/d	of Urea	0 kg/d

Phosphorus : assume waste biosolids contain 2% P, and 2 mg/l soluble P in effluent ensures adequate P for process.

P Addition Required =	0	mg/l	@ (0.02*dXv+2)-Pi	
or	0	mg/l	@ 1% of BODi-Pi	
use the greater value =	0	mg/l	of Phosphorus	
or	0	lbs/d	of Phosphorus	0 kg/d
Chemical Required =	0	lbs/d	of calc. dihyd phos.	0 kg/d
or	0	lbs/d	of ammonium phos.	0 kg/d
or	0	lbs/d	of phos acid (75%)	0 kg/d

APPENDIX B

PROBABLE CONSTRUCTION COST SUMMARY FOR CONCEPTUAL DESIGN

CAROLLO engineers

King County Sammamish ValleyReuse
Reclaimed Water Facility
60-Acres East Site
0.5 MGD Interim Facility w/ aeration basins covered, not in building

2/26/2004

BJE

DESCRIPTION	QTY.	UNIT	UNIT PRICE	INSTALL	TOTAL
Sitework					
Excavation	3,700	CY	$25		$92,500
Backfill	2,900	CY	$30		$87,000
Roadway (gravel)	800	LF	$100		$80,000
Fire supply line (8")	2,200	LF	$65		$143,000
Raw water supply (8")	2,000	LF	$65		$130,000
Effluent line (8")	2,000	LF	$65		$130,000
Drain line (8")	2,000	LF	$70		$140,000
Misc. yard piping	1	LS	$50,000		$50,000
Fencing	1,000	LF	$15		$15,000
Inflluent Pump Station	1	LS	$400,000		$400,000
Influent Screen Building					
Concrete floor	30	CY	$400		$12,000
CMU Building	2,000	SF	$30		$60,000
Roof system	800	SF	$25		$20,000
Screening Equipment	1	LS	$200,000	$30,000	$230,000
Piping	1	LS	$30,000		$30,000
HVAC	1	LS	$30,000		$30,000
Electrical	1		$60,000		$60,000
Treatment Facility					
Concrete floor	300	CY	$300		$90,000
Pre-engineered building	8,000	SF	$30		$240,000
Metal roof structur over aeration basin area	8,000	SF	$20		$160,000
Treatment equipment	1	LS	$1,800,000	$300,000	$2,100,000
Effluent pumping equipment	1	LS	$200,000		$200,000
HVAC	1	LS	$50,000		$50,000
Electrical	1	LS	$400,000		$400,000
Chemical storage	1	LS	$100,000		$100,000
Estimating Contingency (15%)					$757,400
Subtotal					$5,806,900
Sales Tax (8.8%)					$511,000
Direct Construction Cost					**$6,317,900**
Allied Costs @ 30%					$1,895,370
TOTAL BASE PROJECT COST					**$8,213,000**
Single Stage Odor Treatment System	1	LS	$500,000		$500,000
Estimating Contingency (15%)					$75,000
Sales Tax (8.8%)					$50,600
Allied Costs (30%)					$187,700
Total for Single Stage Odor Treadment System					**$813,000**
TOTAL PROJECT COST WITH SINGLE STAGE ODOR TREATMENT					**$9,026,000**
OPTIONAL CONVEYANCE					
8" Supply Line to Willows Run Golf Course	6,000	LF	$65		$390,000
Estimating Contingency (15%)					$58,500
Sales Tax (8.8%)					$39,500
Allied Costs (30%)					$146,400
Total for 8" Supply Line to Willows Run Golf Course					**$634,000**
OPTIONAL SECOND STAGE ODOR TREATMENT					
Compost Filter	1	LS	$400,000		$400,000
Estimating Contingency (15%)					$60,000
Sales Tax (8.8%)					$40,500
Allied Costs (30%)					$150,200
Total for Second Stage Odor Treatment					**$651,000**

RELATIONSHIP OF THE INTERIM RECLAIMED WATER PRODUCTION FACILITY TO RWSP POLICIES	
RWSP Policy	**How Interim Facility Supports Policies**
TPP-7: King County may explore the possibility of constructing one or more satellite treatment plants in order to produce reclaimed water. The county may build these plants in cooperation with a local community and [may] provide the community with reclaimed water through a regional water supply agency. In order to ensure integrated water resource planning, in the interim period prior to the development of a regional water supply plan, King County shall consult and coordinate with regional water suppliers to ensure that water reuse decisions are consistent with regional water supply plans. To ensure costs and benefits are shared equally throughout the region, all reclaimed water used in the community shall be distributed through a regional water supply agency consistent with a regional water supply plan. [*These two sentences taken together mean that when a regional water supply plan is approved, KC will distribute reclaimed water through the regional water supply agency, but prior to that time KC will consult and coordinate with suppliers to ensure that reuse plans are consistent with regional plans.*]	The Interim Facility will be the first satellite facility envisioned in this policy.
TPP-8: King County shall continue water reuse and explore opportunities for expanded use at existing plants, and shall explore water reuse opportunities at all new treatment facilities.	Interim Facility is supportive of this policy.
WRP-1: King County shall actively pursue the use of reclaimed water while protecting the public health and safety and the environment. The county shall accelerate the development of a water reuse program to help meet the goals of the county to preserve water supplies within the region and to ensure that any reclaimed water reintroduced into the environment will protect the water quality of the receiving water body and the aquatic environment.	Every effort is being made to accelerate the reuse program to help preserve water supplies within the region, the Interim Facility is an example of this effort.

WRP-2: Within twelve months of the adoption of this plan, the King County executive shall prepare for review by council a detailed work plan including tasks and schedule for the development of a water reuse program and a process to coordinate with affected tribal and local governments, the state and area citizens. Accompanying the work plan shall be a list of potential pilot projects and associated costs. Development of the water reuse program shall be coordinated with development of a regional water supply plan.	Reuse Plan has been submitted with the satellite project described. The Interim Facility is the continuation of the policy.
WRP-3: Recycling and reusing reclaimed water shall be investigated as a possible significant new source of water to enhance or maintain fish runs, supply additional water for the region's non-potable uses, preserve environmental and aesthetic values and defer the need to develop new potable water supply projects.	The Interim Facility is a direct demonstration of the benefits of reclaimed water being used to enhance and maintain fish runs.
WRP-4: King County's water reuse program and projects shall be coordinated with the regional water supply plans and regional basin plans, in accordance with state and federal standards. Water reuse and water supply/resources must be developed in a manner complementary with each other to allow the most effective management of resources in the county.	The King County Department of Natural Resources and Parks has coordinated with the regional planning efforts including the Outlook the most recent snapshot of water needs and supply and the regional planning effort, Central Puget Sound Initiative.
WRP-5: King County shall implement nonpotable projects on a case-by-case basis. To evaluate nonpotable projects, King County shall develop criteria which may include, but are not limited to: cost; environmental benefits; fisheries habitat maintenance and enhancement potential; community and social benefits and impacts; public education opportunities; risk and liability; demonstration of new technologies; and enhancing economic development.	Stakeholders have been involved in the development and selection of project selection criteria that meet the objectives of this policy.

WRP-6: King County shall work with local water purveyors, including when the local purveyors update their water comprehensive plans, to evaluate the opportunities for water reuse within their local service area.	This process is ongoing for all King County reclaimed water projects. Specific discussions have been conducted with purveyors concerning each of the specific reclaimed water projects.
WRP-7: King County shall develop an active water reuse public education and involvement program to correspond with the development of the water reuse program and be coordinated with other water conservation education programs.	This process is ongoing and not directly related to the Interim Facility.
WRP-8: King County shall utilize a forum or multiple forums to provide opportunities for coordination and communication with the Washington state Departments of Health and Ecology, which have the principal state regulatory roles in the planning, design and construction of reuse facilities. The county shall involve other parties on these forums, including but not limited to, the Corps of Engineers, Washington state Department of Fish and Wildlife, National Marine Fisheries Service, United States Fish and Wildlife Service, regional water suppliers, tribal governments, local water and wastewater districts, cities, local health departments, watershed forums and environmental and community groups.	This process is ongoing and not directly related to the Interim Facility.
WRP-9: King County shall work, on a case-by-case basis, with the Washington state Departments of Health and Ecology on water reuse projects including, but not limited to, those that are not specifically cited in the 1997 Department of Health and Ecology Water Reclamation and Reuse Standards.	This process is ongoing and discussions will continue with DOH and DOE concerning the Interim Facility.
WRP-10: King County shall hold and maintain the exclusive right to any reclaimed water generated by the wastewater treatment plants by the county.	The Interim Facility will continue to support this policy.

WRP-11: King County's water reuse program projects shall not impair any existing water rights unless compensation or mitigation for such impairment is agreed to by the holder of the affected water rights.	None of King County's reclaimed water projects impair existing water rights. The Interim Facility project will replace water rights in the Sammamish Valley by substituting reclaimed water for direct diversions from the river.
WRP-12: King County shall retain the flexibility to produce and distribute reclaimed water at all treatment plants including retaining options to add additional levels of treatment.	This process is ongoing and not directly related to the Interim Facility.
WRP-13: King County shall continue to fund pilot-scale and water reuse demonstration projects, in whole or in part, from the wastewater utility rate base.	The Interim Facility will be funded initially as a demonstration project from the wastewater utility rate base and potential user fees.
WRP-14: King County shall complete an economic and financial feasibility assessment, including environmental benefits, of its water reuse program. The assessment shall include the analysis of marginal costs including stranded costs and benefits to estimate equitable cost splits between participating governmental agencies and utilities. The assessment shall also include a review of existing and planned water and wastewater facilities in an approved plan to ensure that water reuse facilities are justified when any resulting redundant capacity as well as other factors are taken into account.	This process is ongoing and not directly related to the Interim Facility.
WRP-15: King County should pursue development of a water reuse program to discharge reclaimed water to reduce freshwater consumption used in the operation of the Ballard Locks as a priority water reuse project.	This policy is being implemented by the Interim Facility by saving water in the Sammamish River – 'acquiring water rights' and allowing the flow to continue to Lake Washington and out to Puget Sound.