Port of Seattle

attn:
andrea H.

August 18, 2000

Mr. Tom Luster
Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

Dear Mr. Luster:

RE: Revised Implementation Plan for the Des Moines Creek Flow Augmentation Facility

Enclosed is a revised Implementation Plan for the Des Moines Creek Flow Augmentation Facility. The revised plan includes more detailed discussion of alternative water sources (Seattle Public Utilities), treatment for dechlorination (if required), deed restrictions, and other issues. An important change from the initial implementation plan is that an alternative design for the facility has been adopted. This design results in a smaller land area required to construct the facility, which resolves the possibility of the proposed SR509 extension encroaching on the flow augmentation facility, and also provides for the construction of an active or passive dechlorination facility, if necessary.

If you have any questions regarding the implementation plan, Please contact me at 206/988-5528 or smith.k@ portseattle.org.

Sincerely,

Keith R. Smith
Water Resources Manager

Enclosures
Revised Implementation Plan
Excerpts from Basin Plan
Cost Estimate
Construction Schedule
Flow Augmentation Report

c: Elizabeth Leavitt, Michael Cheyne, Tom Hubbard, POS
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Revised Flow Augmentation Implementation Plan for Des Moines Creek
August 18, 2000

This revised implementation plan is response to a request from the Department of Ecology for more information regarding the Des Moines Creek Flow Augmentation Facility. Because construction of the facility is not scheduled to begin until June 2002 (see attached Des Moines Creek Basin Plan Construction Schedule) and the final decision on the source of the water has not been made, the design of the facility has not progressed to the point where detailed design drawings and information is available. However, the Port has worked in the last several weeks to collect more information to provide an additional level of detail about the facility's design and operation. In addition, the Port and the other basin planning committee members are in the final stages of developing the next interlocal agreement, which will cover the final design and permitting of all basin planning projects, including the flow augmentation facility. This work is scheduled to be completed in 2001. While the current plan calls for flow augmentation from the Port-owned well, the Port will commit to funding the design and construction of the facility using water from Seattle Public Utilities (SPU) if the water right issue cannot be resolved by the time construction needs to start, and final approval from SPU is obtained. Available details on the design alternatives are presented in this document.

The Port and the Des Moines Creek Basin Planning Committee are still considering two sources for the water: the Port-owned well currently used to irrigate the Tyee Valley Golf Course, and water from Seattle Public Utilities through the Port's existing connections. The Port has initiated discussions with SPU to determine the feasibility of the second option. SPU has preliminarily indicated that the Port's existing connections are of adequate size to provide water to meet both the needs of the airport and the volume proposed for flow augmentation, that the water for flow augmentation would be available when needed, and the willingness to sell the Port water for flow augmentation. Considering the maximum annual volume proposed for augmentation, the maximum increase in volume over existing annual use at the airport is 33.4%. (Annual existing airport use is 30,951,800 cubic feet; maximum annual flow augmentation amount is 10,951,800 cubic feet.) In reality, since the target flow in the stream (combined natural flow and augmentation flow) is one cfs, and the maximum augmentation rate and duration is based on the most extreme climatic conditions, actual use for flow augmentation would be less than the maximum value of one cfs. SPU is meeting later in August to discuss the Port's request in more depth.

Although the Port is committing to flow augmentation from either source, the well is the preferred option, assuming the water right issue can be satisfactorily resolved. Use of water from SPU is more complex and costly due to the need to construct a pipeline from the airfield, construct and operate a dechlorination facility, and the cost to purchase the water ($2.29 per 100 cubic feet at the current commercial rate charged to the Port during peak usage time of May 16 through September 15.) Costs associated with the well option are much lower and include modifying the wellhead, replacing the existing pump with a variable-speed pump, constructing a shorter discharge pipe, and electricity to run the pump. Both sources will be able to provide water in perpetuity. If the well is the selected source, water rights are issued in perpetuity.

Although a water right is technically subject to curtailment if the uses of senior rights in the basin cannot be met, this has not happened in the more than 50 years that this well has been used. If SPU were the selected source, water for flow augmentation would have the same assurance of supply as the Port's current use and all other uses that obtain their water from SPU. SPU has historically been able to meet demands, therefore, in both cases; the availability of a source in perpetuity is assured. The Port and its legal counsel believe it has strong arguments that the water right associated with the well is valid, and will be presenting that information to Ecology's Water Resources program staff in support of our current Water Right Change application.

If the water right issue is resolved favorably and the well is selected as the source of augmentation water, the well and associated equipment will be modified. The Port and the basin planning committee have studied two pump configurations. One configuration would replace the existing pump with a submersible pump and motor. Specifications include a 75-Hp, 3500-rpm motor with 2-stage pump bowls optimized for the 12-inch well casing. The other configuration replaces the existing pump with a turbine pump (motor mounted on top of the well with a shaft extending to a submerged pump). This configuration uses a motor similar to the submersible pump, but the pump is a 7-stage pump with 8-inch bowls. Both pump configurations allow for variable speed operation to allow the augmentation flow to be matched to the needs of the stream. The existing pump does not allow for this type of operation. The primary differences between the two proposed configurations are cost and efficiency (submersible pumps are generally more efficient because the motor is connected directly to the pump.) Water would be delivered to the stream through a discharge line, either through a stilling basin and rock channel, or through an existing pond and constructed channel (see discussions below). Estimated construction costs for the flow augmentation facility using the well as the water source are attached.

If SPU water is used, it will need to be conveyed to the augmentation site and treated prior to being introduced into the stream. The Port will construct a pipeline from Port-owned water mains on the airfield through Port-owned property to the flow augmentation site. The pipeline would be six or eight inches in diameter and approximately 4,500 feet in length. The proposed route will be along the perimeter road east of runway 34R and taxiway A to a point adjacent to the golf course, and then through the golf course to the flow augmentation site. The entire route is on Port property. No wetlands will be impacted by the pipeline or other facilities associated with the flow augmentation project. A valve controlled by the stream monitoring system will control the discharge from the pipeline into the treatment system. Review of water quality reports from SPU indicate that removal of chlorine is the only treatment required as no other constituents are present in amounts that cause toxicity concerns or that violate water quality standards. Preliminary consultation with Kennedy-Jenks, an engineering firm retained by the Port for water treatment issues, indicate that two types of dechlorination systems are possible for the flow augmentation facility. One is a chemical-feed system consisting of a mixing chamber and a holding tank sized to provide adequate contact time. The chemical used will probably be sodium thiosulfate, although a system could be designed to use other chemicals. Sodium thiosulfate is a readily available chemical used in the photo processing industry, as an antidote to cyanide poisoning, and in products to dechlorinate tap water for use in home aquariums. The last use is of interest because it demonstrates the chemical can be used to dechlorinate water with no harmful effects to fish and other aquatic organisms. Introduced in liquid form, the reaction with

chlorine is virtually instantaneous. Based on the expected residual chlorine concentration of the supply water (1 milligram per liter or less) and the volume of flow, the size of the mixing chamber and tank is on the order of a common residential septic tank, something that could easily be constructed at the flow augmentation site. A mechanism to match the rate of chemical injection to the variable rate needed for augmentation would need to be designed. Similar facilities have been developed to provide dechlorination for many industrial uses, so the technology exists and can be readily adapted for the flow augmentation project.

The other option for providing dechlorination is a passive-type system. Sunlight is very effective in reducing chlorine concentrations, so a small holding pond exposed to sunlight could provide an adequate level of dechlorination. In fact, an alternate design for the flow augmentation facility has the well discharging into an existing pond on the golf course, and then into the creek through a constructed channel over weirs to provide aeration (see attached figure). Note that the scale of this figure does not allow it to show the monitoring station(s), which would be constructed regardless of the water source. This option could be adopted to provide dechlorination of SPU water. Advantages to this type of system are its simplicity, ability to handle variable flows, and low construction and operational costs. Given the variability of sunlight during the times when augmentation is required and the pond's impact on water temperature, this option will be researched and developed further. As stated in other flow augmentation documents (attached), the plan includes monitoring and testing during the first year of operation to determine the effects of various temperature settings on downstream temperatures, and determining the optimal augmentation rates to achieve the desire results. Impacts on temperature of the holding pond will also be evaluated during this period. If SPU water is the selected source, the Port commits to evaluating all dechlorination alternatives and constructing the one that is best suited for the flow augmentation project.

No matter what [redacted]er source, a minimum of one monitoring station needs [redacted]e constructed, [redacted]h to provide control over the augmentation facility and to provide data on the effectiveness of the project. (Early in the project, to avoid having to construct a monitoring and control system, the basin planning committee evaluated simply opening the well and letting it flow continuously throughout the summer, but dismissed this option.) The Port will evaluate the option of constructing two monitoring stations (upstream and downstream) to allow the collection of more complete data on the facility. As stated in the previous plan, the monitoring facility (ies) will be constructed at one or more of the three existing weirs on the reach on Des Moines Creek between the confluence of the east and west branches and south 200th Street. The existing rectangular weir(s) will be modified by adding a V-notch or Parshall flume to achieve more accurate measurements during low flows. Trash racks will be included to prevent debris from accumulating in the flow measurement section, and a stilling well(s) will be constructed at the weir(s) to contain the water level and temperature sections. A streamflow rating curve will be developed for the modified weir(s), and depths corresponding to a 1 cfs flow rate will be established.

The Port consulted with Taylor and Associates, its consultant on water quality monitoring. Taylor and Associates have experience developing monitoring and control equipment on similar flow augmentation projects. Commercially available probes with analog (4-20 milliamps) will sense flow and temperature (and dissolved oxygen, if desired.) The heart of the system will be a

Campbell Scientific CR10X or CR500 programmable recorder/controller. This unit will receive signals from the monitoring station(s), and will be programmed with logic to turn on the well pump (or open the pipeline valve if SPU is the source), control the pumping rate or pipeline flow, and record streamflow and temperature. The unit can also be set up to provide remote access, query, and programming using cell phone or hard-wire technology; or alternatively, incorporated into the Port's telemetered maintenance/operation system. Control and target conditions will be defined to optimize operation of the flow augmentation facility. Persistence or rate of change in flow and temperature will be established to prevent rapid pump (well) or valve (pipeline) cycling. It is envisioned that temperature and flow data will be collected at fifteen-minute intervals. It will be established if a single reading below one cfs or over 16C would activate the pump or valve, or if a specific duration would pass before the system is activated. Programming in a specific duration before activation would eliminate false starts due to the system noise inevitable in electronic monitoring/sensing equipment. Logic to resolve this issue will be developed and programmed into the control module, and can be modified based on operational experience.

Because of the current uncertainty over the source of water, the resulting uncertainty over the need to construct a dechlorination facility, and the desire to keep the components of the flow augmentation facility in a small area to minimize potential conflicts with other projects (SASA and the proposed SR509 extension), the Port has decided to pursue the design utilizing the pond and constructed channel to the creek, and not construct a discharge pipeline to a point near the confluence of the east and west branches, no matter which source of water is developed. This assures that the flow augmentation facility will not interfere with other proposed projects in the area. WSDOT was consulted via their participation in the basin planning committee, and has confirmed that the selected layout and location does not interfere with the SR509 alignment. The Port's legal counsel (Foster Pepper & Shefelman) is developing language for restrictive covenants for a variety of Port projects. Foster Pepper has been provided information regarding the layout and location of the proposed flow augmentation facility, and will develop a restrictive covenant specific to the flow augmentation project. The Port will continue to coordinate with the basin planning committee to assure that the restrictions are consistent with basin planning projects in the area.

Low Flow Augmentation

Des Moines Creek experiences summer low flows that stress aquatic flora and fauna by desiccation and elevated temperatures. The summer low flows reduce refuge area and result in elevated temperature and depressed dissolved oxygen levels that exceed the tolerance of the salmonids in the system. The Basin Plan recommends augmenting the stream flows with cooler, aerated well water from the underlying aquifers. The best candidate well for this alternative is the active well currently used for irrigation at the Tyee Golf Course (Well No. 1 in Figure 12). The well withdrawal objective is to add 1.0 cubic foot per second (448 gallons per minute) of flow to Des Moines Creek during summer low flow.

Previous studies were conducted by Parametrix, Inc., and Foster Pepper Associates for the Port of Seattle to plan a method of low flow augmentation for Des Moines Creek (see Appendix I). This plan has detailed the withdrawal capacity, water rights, and proposal of operation systems for wells on the Port of Seattle property.

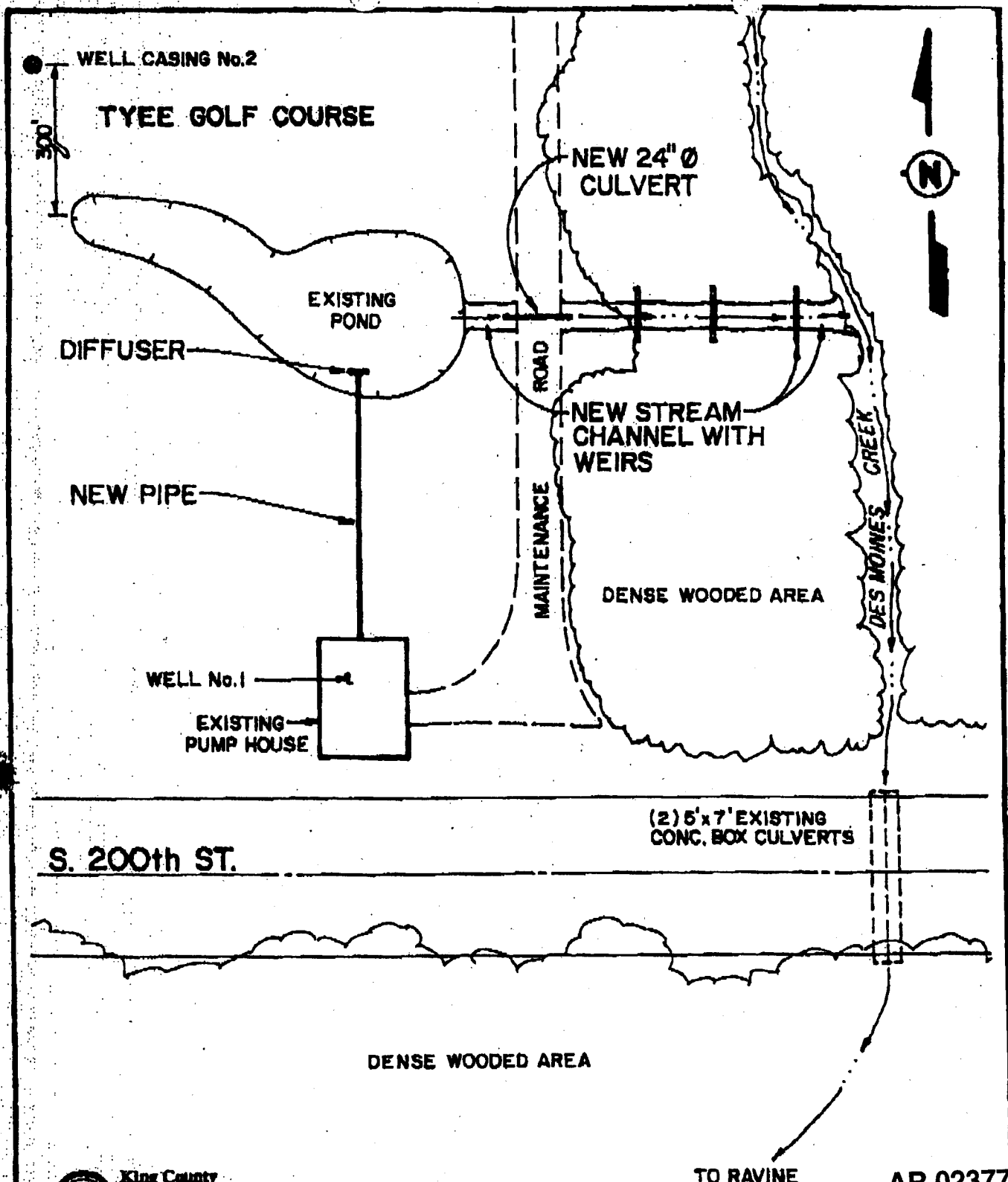
The Design Team has prepared the preliminary design and cost estimate (see Appendix I) for the use of the currently active irrigation well, Well 1, on Tyee Golf Course approximately 100 feet north of South 200th Street (see Figure 12).

Assessment of Existing Well

The two wells in the vicinity of Des Moines Creek are located immediately north of South 200th Street (see Figure 12). The wells were drilled by Richardson Well Drilling Company between 1949 and 1953. One of the wells is still in use by the Tyee Golf Course for irrigation of the golf course greens. This well, located inside the well house on the north side of South 200th Street, reportedly has a capacity of 1,200 gpm (=2.67 cfs) with 8 feet of drawdown (Parametrix, 1998). The Port of Seattle and Highline Water District are currently discussing water right and ownership issues with this well; both entities have expressed support for the *Des Moines Creek Basin Plan* and the flow augmentation concept.

Well logs available from the November 1949 drilling report that the active well has a casing with two sets of perforations (screens) (see Figure 13). The first, between 72 and 160 feet, is above the first aquitard and the second, between 190 and 243 feet, has an aquitard that makes it a confined aquifer. The well is configured so that the lower aquifer contributes the most flow. The Tyee Golf Course is currently irrigating the golf course at a rate of up to approximately 350 gpm.

The inactive well, Well 2, is approximately 500 feet north of the active well and the open well head is visible. The Department of Ecology does not have the well logs for the inactive well. In order to find the depth of the inactive well screen and document it, GELCO Services, Inc., was hired to televise the well and inspect its condition and suitability of the casing and the screen for re-activation (see Appendix I). The well was televised on February 16, 1999. The well casing was overgrown with algae and the well screen was visible right before the well terminated at approximately 130 feet below ground level. This puts the screen in the upper aquifer, which is unconfined according to the August 18, 1998, Parametrix report. Withdrawal from this aquifer would probably have an impact on the Des Moines Creek recharge. Therefore, the Design Team pursued no further consideration of Well 2 for this proposal.



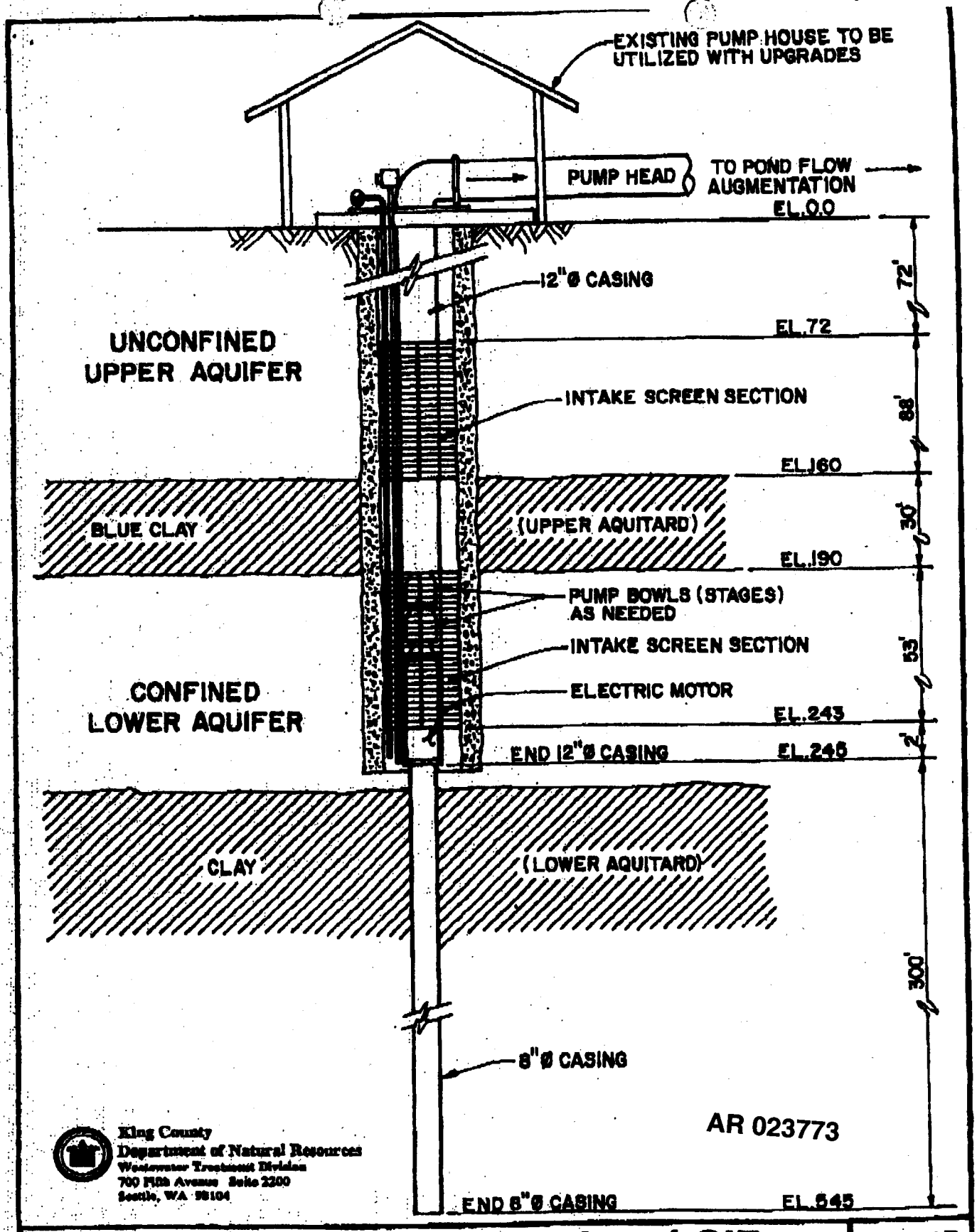
King County
Department of Natural Resources
Wastewater Treatment Division
700 Fifth Avenue Suite 2200
Seattle, WA 98104

AR 023772

PROJECT No.3AI767

Des Moines Creek Well Improvements
LOW FLOW AUGMENTATION

FIGURE 12



Des Moines Creek Regional CIP
WELL NO.1

FIGURE 13

Proposed Well System

The Design Team selected use of the existing well, Well 1, for the stream flow augmentation. This system is operational and would require equiptment upgrades and conveyance to Des Moines Creek via an existing pond north of the well house (see Figure 12). This well is installed to withdraw water from two confined aquifers. A larger pump-motor system is required with capacity to lift 448 gpm for low flow augmentation in addition to the 350 gpm used for golf course irrigation.

The water withdrawn would be split to provide for the golf course irrigation system and for outflow to an existing pond 100 feet north of the existing well house. The pond would outflow approximately 100 feet east to Des Moines Creek via open channel with drops to provide aeration.

Pump Configurations

For the stream flow augmentation, two different pump starting options were studied. In the first option, the pump would be turned on in the beginning of the summer and allowed to run continuously throughout the summer. The second option is to employ a temperature or low flow sensor triggered starting mechanism. When the temperature reaches a pre-determined threshold or low flow, the pump would be started and run until the conditions change. The costs associated with the options below do not include cost of automated pump on/off trigger, pump house changes, pipe to pond, and the new channel to the stream. The two possible pump configurations are described below.

Pump 1: Submersed motor and turbine. Both the pump and the motor would be submerged. 3500 rpm, 2 stage pump bowls, optimally 12-inch internal diameter well casing. 75 Hp electric motor needed (assuming irrigation system has separate pump to pressurize it.) Pump and motor cost approx. $8,000. Discharge piping and wire cost approx. $4,000. Control panel cost approx. $4,500. The total cost is $16,500.

Pump 2: Line shaft turbine pump and top mounted motor. The pump is submerged and the motor is on the surface, connected with a shaft. 7 stage, 8-inch pump bowls, optimally 12-inch internal diameter well casing. 75 Hp electric motor needed (assuming irrigation system has separate pump to pressurize it). Pump and motor cost approx. $15,000. Control panel cost approx. $4,500. The total cost is $19,500.

DES MOINES CREEK REGIONAL CIP
PRELIMINARY CONSTRUCTION COST ESTIMATE

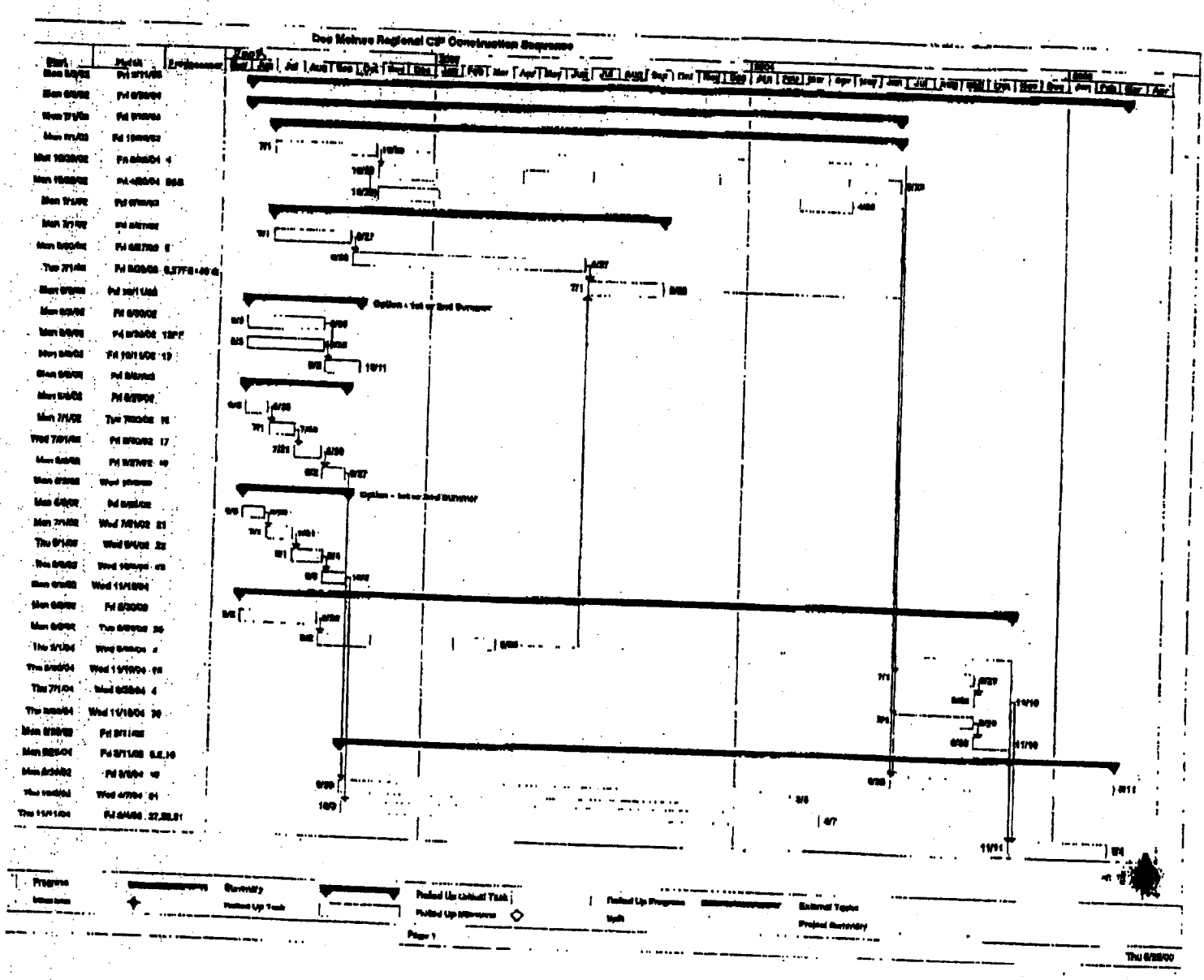
PROJECT: Low Flow Augmentation

DATE: 4/15/99
ESTIMATOR: WHK

PRELIMINARY CONSTRUCTION COSTS						
ITEM	ITEM DESCRIPTION (Furnished and Installed)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	LS	10%	% OF SUM	$5,105
2	Clearing and Grubbing (Light cover)	0.1	ACRES	$3,000	/ACRES	$300
3	Excavation (including haul off-site) *	25	CY	$9	/CY	$225
4	Hydroseeding	0.1	ACRES	$1,600	/ACRE	$160
5	Wellhouse upgrades	1	LS	$20,000	/LS	$20,000
6	Pump and motor	1	LS	$8,000	/LS	$8,000
7	Discharge piping and wire	1	LS	$4,000	/LS	$4,000
8	Control panel	1	LS	$4,500	/LS	$4,500
9	Automated on/off trigger	1	LS	$3,000	/LS	$3,000
10	" 24" Diam. H.D.P.P.	20	L.F.	$89	/L.F.	$1,786
11	" 12" Diam. H.D.P.P.	45	L.F.	$53	/L.F.	$2,383
12	Weir	3	EACH	$500	/EACH	$1,500
13	Coir Fabric	40	S.Y.	$8	/S.Y.	$320
14	Straw Bales	25	EACH	$20	/EACH	$500
15	High Visibility Fence	75	L.F.	$4	/L.F.	$300
16	Filter Fabric Fence	75	L.F.	$5	/L.F.	$375
17	Clear Plastic Covering including removal	150	S.Y.	$2	/S.Y.	$225
18	Surrounding site restoration (sod, gravel, roads, etc.)	1	LS	$2,000	/LS	$2,000
19	Construction Survey	1	LS	$1,500	/LS	$1,500

SUBTOTAL:		$56,158
SALES TAX:	6.60%	[illegible]
SUBTOTAL:		$60,[illegible]
CONTINGENCY:	20.00%	$12,197
CONSTR. SUBTOTAL:		$73,185
INFLATION '99 TO '01	10.00%	$15,417
CONSTRUCTION TOTAL		$88,602

AR 023775


Des Moines Regional CSP Construction Sequence