SULTAN CITY COUNCIL
AGENDA ITEM COVER SHEET

ITEM NO: A-2

DATE: July 8, 2010

SUBJECT: WWTP short-term improvement alternatives

CONTACT PERSON: Deborah Knight, City Administrator

ISSUE:

The issue before the city council is to review and discuss funding short-term improvements to the waste water treatment plant (WWTP) using the $335,000 state legislative proviso.

STAFF RECOMMENDATION:

1. Review technical information prepared by Brown and Caldwell in 2006, 2007 and 2010 on short-term improvements to the waste water treatment plant.

    - Attachment A – *2006 WWTP Upgrade Engineering Report* Executive Summary "Recommended Capacity Upgrade" pages ES-5 through ES-7
    - Attachment B - Waste Water Treatment Plant Short-Term Improvement Chart
    - Attachment C– Accommodating Short Term Growth (Revised 04/24/2006)
    - Attachment D – Sultan WWTP Short-Term Hydraulic Improvements (09/25/06)
    - Attachment E – Hydraulic Capacity Improvements to the Sultan Main Pump Station (03/26/07)

2. Approve the staff recommended alternative to allocate the $335,000 legislative proviso to upgrade the intermediate pump station (~$200,000) and begin the design to upgrade the influent pump station (~$135,000).

SUMMARY:

The city received a $335,000 state legislative proviso for fiscal year 2010 for "the Sultan waste water treatment plant facility." The funds are managed through the Department of Ecology (DOE). The funds are available July 1, 2010. DOE requires the city to submit a scope of work in order to approve the expenditure in accordance with the legislative proviso.

The city council needs to determine the best use of the legislative proviso funds and provide direction to staff on the scope of work. The city may need to issue a formal

request for qualifications (RFQ) seeking engineering firms to assist with design and construction of short-term improvements.

ANALYSIS:

Treatment Plant Capacity

The city operates the waste water treatment plant through a National Pollution Discharge Elimination System (NPDES) permit issued by the Department of Ecology. The city's NPDES permit allows a maximum month flow of .72 million gallons per day (MGD). Due to development activity in 2005, the city realized new development would result in exceeding 85% of the plant capacity of .72MGD. The city's NPDES permit requires planning for an upgrade when the plant exceeds 85% of its capacity.

The city started working on planning and capital improvements to upgrade the waste water treatment plant (WWTP) to accommodate anticipated growth in 2005. The city evaluated five alternatives. The alternatives analysis is detailed in the *Waste Water Treatment Plant Engineering Report (September 2006)* produced by Brown and Caldwell.

Proposed Plant Upgrade

The outcome of the 2006 *Engineering Report* was a decision by the city council to proceed with upgrading the existing WWTP accommodating peak flow with the existing facilities and base flows with membrane treatment at the current facility.

The cost estimate of the plant upgrade in the *2006 Engineering Report* was $15.9 million in 2006 dollars spread over six years including secondary improvements in 2017 and 2021. The proposed improvements would serve a population of 12,540 with 5,098 Equivalent Residential Units (ERUs).

Short-Term Improvements

In addition to the plant upgrade, the *2006 Engineering Report* recommended a set of short-term improvements that were common to all the alternatives evaluated (see Attachment A for a complete list):

- Upgrade the effluent pump station by modifying the pumps – completed 2007
- Upgrade the UV disinfection system by moving one bank of lights – completed 2009
- Purchase and install a centrifuge to improve solids handling - completed in 2009.
- Add one screw pump in the open slot of the intermediate pump station – proposed 2011
- Upgrade the influent pump station by replacing the pumps and the 8-inch main on the SR 2 Bridge. Add variable frequency drivers to the influent pump – design proposed for 2011.
- Modify the existing return activated sludge (RAS) flow routing.

- Add two UV banks.
- Upgrade the supervisory control and data acquisition (SCADA) communication system between the plant and the influent pump station – combine with influent pump station improvements.

Recommended Alternatives

Since funding for the plant full upgrade is not available at this time, city staff recommend the city council continue focusing on completing the short-term improvements outline in the *2006 Engineering Report*.

A recent analysis of the short-term improvements (Attachment B) indicates the city could remove existing bottlenecks at the WWTP and add approximately 1603 equivalent residential units for roughly $3.4 million dollars:

	Constraint/Limitation	Constraint Type	Description	ERUs Gained	Cost
1	Intermediate PS Firm Capacity	Peak Hour	To meet Orange Book redundancy requirements, add on screw pump in the open slot of the intermediate pump station	214	$200,000.00
2	Influent PS Firm Capacity	Peak Hour	To meet Orange Book redundancy requirements, a 3rd pump is required. Rebuild pump station and install 10" force main suspended above Sultan River	809	$2,540,000.00
3	Plant Rating	Max Month	Rerate plant from 0.72 mgd to 0.74 mgd	79	$25,000.00
4	Secondary Clarifier Loading	Max Month	Additional secondary clarifier capacity needed. Can be achieved by chemical addition to increase separation efficiency or by addition of a new clarifier.	501	$650,000.00
	TOTAL			1603	$3,415,000.00

Like the centrifuge project, the proposed list of short-term improvements are common to all the upgrade alternatives considered in the*2006 Engineering Report.* Meaning, even if the city decides to select another alternative in the future, these improvement could be incorporated into the final plant design.

Also in 2010 the city has been experiencing maintenance and operation issues at the influent pump station. Like the centrifuge project, the city can improve plant efficiency and lower operating costs by addressing the influent pump station firm capacity.

Other Alternatives Considered

Move forward on completing the 50% design

In 2008, the city expended the $1,000,000 public works trust fund loan for the WWTP design. The city had anticipated using connection fees to complete the design. Due to the down turn in the housing market, additional city funds were not available to complete the design as planned. The city council directed stopping the design to upgrade the WWTP at 50% completion.

The city could use the $335,000 to move the design forward from 50%. The estimate to complete the design is between $750,000 and $1,000,000.

The downside to this alternative is the uncertainty of when the economy will recover sufficiently to fund the $15.7 million plant upgrade. It's clear the city is nearing the plant capacity. The proposed short-term improvements can add interim plant capacity to serve the city's short-term (5-7 year) needs at one-fifth the cost ($3.4 million versus $15.7 million).

Convert the 2006 Engineering Report to a Facility Plan

In order to be eligible for State Revolving Fund (SRF) money through Washington State, the city is required to convert the *2006 Engineering Report* to a Facility Plan.

The first step in converting the engineering report to a facility plan is completing the environmental work (SEPA/NEPA). The cost estimate for the NEPA/SEPA work is approximately $80,000.

There are very few funding sources for the WWTP upgrade. The city could apply for a public works trust fund loan to construct the project. Unfortunately, the state legislature "swept" the fund to balance the 2010-2011 budget. It may be some time before funding is available through the public works trust fund. The other source of funding is the State Revolving Fund which is managed through the Department of Ecology. In order to apply for SRF money, the city must have an adopted Facility Plan.

If the *2006 Engineering Report* was converted to a Facility Plan for State Revolving Fund application, additional screening criteria and cost analysis would need to be included to show that the preferred alternative is overall the least cost alternative. The scoring for the alternatives in the *Engineering Report* was done without associating a dollar amount to non-cost criteria such as effluent quality and schedule delays. It is likely the city's preferred alternative would not be the low cost alternative.

If there is going to be a 5 to 7 year delay before the WWTP upgrade is constructed, it may be prudent to complete the short-term improvements before updating the *2006 Engineering Report* to a Facility Plan and then revisiting the plant design.

Purchase adjacent properties

The city has been approached by willing sellers adjacent to the WWTP. With the housing market at an all time low it makes sense to consider purchasing adjacent properties. The *2006 Engineering Report* recommends purchasing surrounding properties for future plant expansion.

City staff checked with the Department of Ecology about using the $335.000 legislative proviso for property acquisition. Unfortunately, DOE determined the proviso money may not be used for property purchase.

FISCAL IMPACT:

City staff are seeking to use the $335,000 legislative proviso in order to get the "biggest bang for the buck".

The proposed alternative would purchase and install the intermediate pump for approximately $200,000. This would remove one of the plant bottlenecks and set the city up to increase the number of ERU's needed to serve future development.

The remaining funds would be used to design the influent pump station upgrade and replace the 8" force main suspended from the US 2 Bridge. The city will need to set aside funds in 2011 to complete the influent pump station design and seek funding to construct the pump station improvements. The force main could be designed in 2011 and constructed in 2012 or 2013.

RECOMMENDED ACTION:

1. Review technical information prepared by Brown and Caldwell in 2006, 2007 and 2010 on short-term improvements to the waste water treatment plant.

2. Approve the staff recommended alternative to allocate the $335,000 legislative proviso to upgrade the intermediate pump station (~$200,000) and begin the design to upgrade the influent pump station (~$135,000).

ATTACHMENTS:

Attachment A – *2006 WWTP Upgrade Engineering Report* Executive Summary "Recommended Capacity Upgrade" pages ES-5 through ES-7

Attachment B - Waste Water Treatment Plant Short-Term Improvement Chart

Attachment C– Accommodating Short Term Growth (Revised 04/24/2006)

Attachment D – Sultan WWTP Short-Term Hydraulic Improvements (09/25/06)

Attachment E – Hydraulic Capacity Improvements to the Sultan Main Pump Station (03/26/07)

Alternative 5: Accommodate Peak Hour Flow with Equalization and Peak Day Flow with Membrane Treatment. The approach of Alternative 5 is to handle the peak hour flow with equalization tanks and the peak day flow with MBR treatment. This approach requires a large equalization volume because of the high peak hour flow, and a large initial MBR capacity to accommodate the relatively large peak day flows.

Alternative Selection

All five alternatives were screened by the Core Team. Alternatives 4 and 5 were screened out due to their significantly higher capital and O&M costs and were not further evaluated. Alternatives 1, 2, and 3 were scored by the Core Team. The scoring was done without associating a dollar amount to non-cost criteria such as effluent quality and schedule delays. If the Engineering Report was to be converted to a Facility Plan for State Revolving Fund application, additional screening criteria and a cost analysis would need to be added to show that the preferred alternative is overall the least cost alternative.

As a result of the alternative evaluation, the Core Team selected Alternative 3 as its recommended alternative for upgrading the Sultan WWTP. The main reasons for selecting Alternative 3 are as follows:

- **Avoid stranded investment.** The ability to convert to a full membrane plant in the future with minimal stranded investment.
- **Operational flexibility and ease of operation.** The higher ease of operation due to the MBR system automation. The higher operational flexibility due to the flow split between the oxidation ditch and the MBR system.
- **Potential for phasing.** The ability to re-evaluate the influent flow peaking factor within the 20-year planning horizon and potentially avoid future construction of equalization storage volume. The ability to add MBR equipment commensurate with actual growth, instead of including upfront all the equipment needed to treat future flows.
- **High quality treatment.** The better effluent quality, with an innovative but proven technology offering much lower risk than the CEPT technology.
- **Minimize odor, noise, and visual impacts.** The smaller footprint with its associated smaller visual impact. The ability to avoid land acquisition for this upgrade.

SULTAN WWTP RECOMMENDED CAPACITY UPGRADE

Under the recommended WWTP upgrade, all wastewater from the Sultan UGA will be conveyed to the existing treatment plant headworks for screening and grit removal. The screened and degritted flow will be pumped and split between treatment paths based on the

influent flow rate. Base sanitary flows will be directed through new mechanical fine screens, aeration basins, and MBR system. Flows exceeding the MBR capacity will be processed through the existing oxidation ditch and secondary clarifiers. Waste activated sludge will be stored in a new solids holding tank/aerobic digester and will be dewatered using a high-solids centrifuge prior to being hauled off-site for composting.

Alternative 3 upgrade components are listed below. The first part of the list includes the elements that were common to all upgrade alternatives, the second part of the list summarizes elements specific to Alternative 3, the recommended upgrade.

Elements Common to All Upgrade Alternatives

The short-term improvements recommended for completion by the end of 2007 are as follows:

- Upgrade the effluent pump station by modifying the pumps.
- Upgrade the UV disinfection system by moving one bank of lamps to the existing, parallel channel
- Upgrade the influent pump station by replacing the pumps and the 8-inch pipe on the SR-2 Bridge.[1] Add variable frequency drives to the influent pumps.
- Purchase and install a centrifuge to improve the solids handling process.
- Increase the operation staff at the WWTP by one full time employee.
- Perform a dilution study to evaluate the effluent dilution criteria and associated anticipated NPDES permit limits for future flows.

The Phase I (completion in 2009) improvements common to all alternatives include the following upgrades to the existing facility:

- Modify existing return activated sludge (RAS) flow routing by permanently closing the slide gate in the wall of the existing RAS box in order to create a wet well for a pump. The RAS flow will then be pumped to the oxidation ditch instead of flowing over a weir to the bioselector. The existing bioselector will therefore only contain raw influent and no longer be used as a bioselector.
- Add one screw pump in the open slot of the intermediate pump station.

[1] The 8-inch pipe could be replaced later than 2007. The options for replacing this pipe are a 12-inch pipe under the Sultan River or a 10-inch pipe on the SR-2 bridge. The replacement option should be selected prior to the influent pump selection.

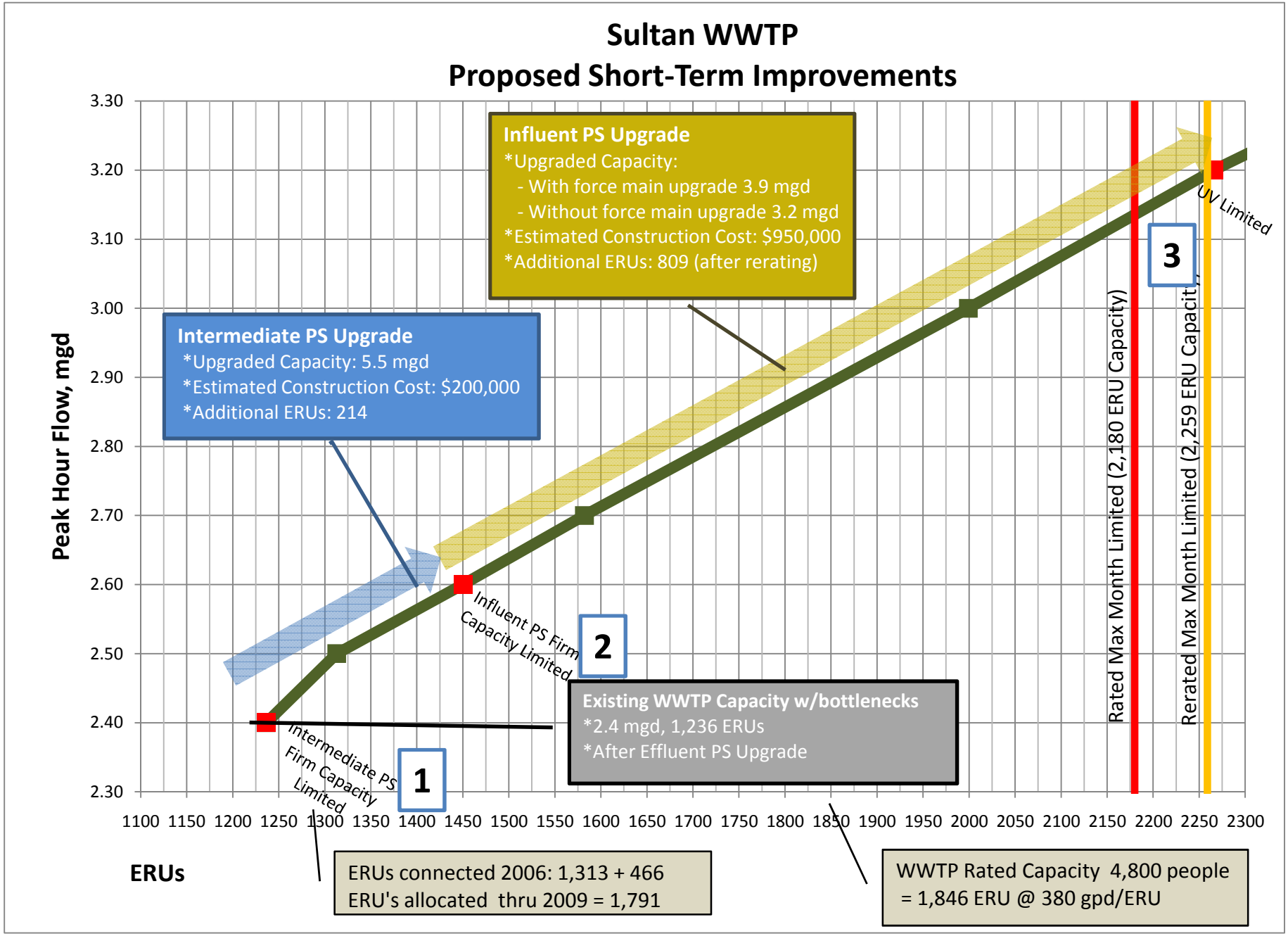
- Add two UV banks (Trojan UVB3000, 64 lamps per bank). A UV still well will be extended to the south to provide for uniform flow distribution through the UV lamp array.
- Upgrade the supervisory control and data acquisition (SCADA) communications system within the plant and between the plant and the influent pump station (Sultan Main Pump Station).
- Modify the influent flow meter (Parshall flume) by increasing the channel length to the south.
- Install an effluent flow meter for effluent flow reporting to the Washington State Department of Ecology (Ecology). Install a magmeter in a new vault on the 12-inch diameter effluent pipe.
- Improve the weather protection for the headworks, UV, and effluent pumping equipment. Add partial walls around equipment.
- Evaluate outfall for potential upgrade requirements (study).
- Provide for future odor control installation for headworks and solids building areas.
- Provide improvements to the solids handling facilities.

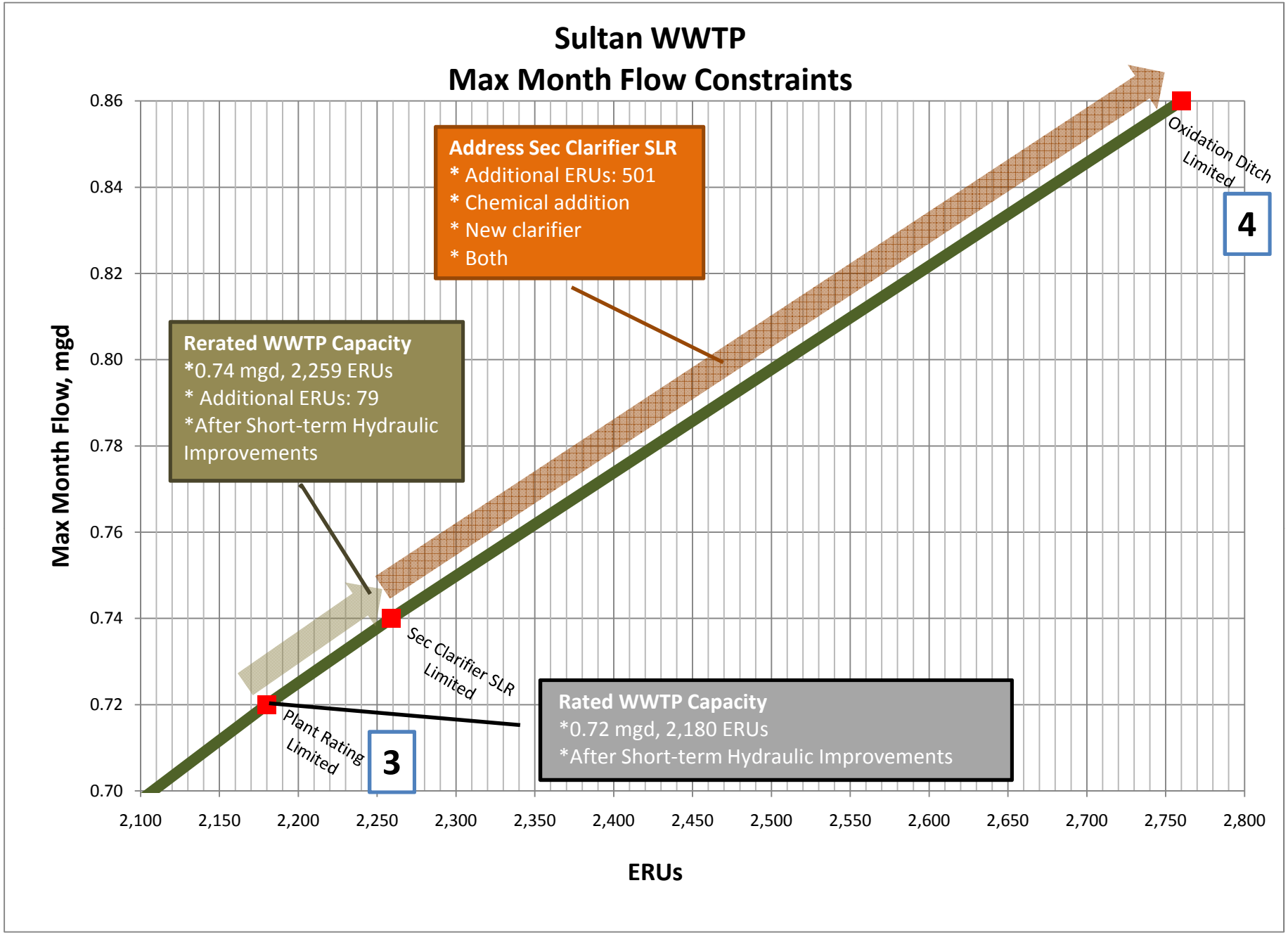
Additional Process Upgrades Specific to Alternative 3

The following Phase I upgrades would also be implemented by 2009:

- Add aeration tanks to accommodate the 0.9-mgd average flow and 1.8-mgd peak hour flow. The aeration tank will have an approximate volume of 0.17 million gallons).
- Add piping to allow for influent flow splitting between the MBR and the oxidation ditch, and for blending the effluent from the MBR and the secondary clarifiers.
- Add a mechanical building to accommodate MBR equipment for the 0.9-mgd average flow and the 1.8-mgd peak hour flow.
- Add MBR equipment to accommodate 0.6 mgd of the average flow and 1.2 mgd of the peak hour flow.
- Add a fine screening facility west of the existing headworks.

Phase II upgrades (to be implemented by 2017):


Sultan WWTP
Proposed Short-Term Improvements
Peak Hour Flow, mgd
3.30
3.20
3.10
3.00
2.90
2.80
2.70
2.60
2.50
2.40
2.30
1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 2100 2150 2200 2250 2300
ERUs
Influent PS Upgrade
*Upgraded Capacity:
- With force main upgrade 3.9 mgd
- Without force main upgrade 3.2 mgd
*Estimated Construction Cost: $950,000
*Additional ERUs: 809 (after rerating)
Intermediate PS Upgrade
*Upgraded Capacity: 5.5 mgd
*Estimated Construction Cost: $200,000
*Additional ERUs: 214
Existing WWTP Capacity w/bottlenecks
*2.4 mgd, 1,236 ERUs
*After Effluent PS Upgrade
Intermediate PS Firm Capacity Limited
Influent PS Firm Capacity Limited
UV Limited
Rated Max Month Limited (2,180 ERU Capacity)
Rerated Max Month Limited (2,259 ERU Capacity)
1
2
3
ERUs connected 2006: 1,313 + 466
ERU's allocated thru 2009 = 1,791
WWTP Rated Capacity 4,800 people
= 1,846 ERU @ 380 gpd/ERU


Sultan WWTP
Max Month Flow Constraints
Address Sec Clarifier SLR
* Additional ERUs: 501
* Chemical addition
* New clarifier
* Both
Rerated WWTP Capacity
*0.74 mgd, 2,259 ERUs
* Additional ERUs: 79
*After Short-term Hydraulic Improvements
Rated WWTP Capacity
*0.72 mgd, 2,180 ERUs
*After Short-term Hydraulic Improvements
Oxidation Ditch Limited
4
Sec Clarifier SLR Limited
Plant Rating Limited
3
Max Month Flow, mgd
ERUs
0.86
0.84
0.82
0.80
0.78
0.76
0.74
0.72
0.70
2,100
2,150
2,200
2,250
2,300
2,350
2,400
2,450
2,500
2,550
2,600
2,650
2,700
2,750
2,800

	Constraint/Limitation	Constraint Type	Description	ERUs Gained		Cost
1	Intermediate PS Firm Capacity	Peak Hour	To meet Orange Book redundancy requirements, a 3rd pump is required	214	$	200,000.00
2	Influent PS Firm Capacity	Peak Hour	To meet Orange Book redundancy requirements, a 3rd pump is required. Rebuild pump station and install 10" force main suspended above Sultan River	809	$	2,540,000.00
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					$	3,415,000.00

BROWN AND CALDWELL

TECHNICAL MEMORANDUM

Project:	City of Sultan Wastewater Treatment Plant Facility Plan		
Project Number:	129795	Date:	March 28, 2006
Prepared by:	Corinne Jeuch	Revised:	April 24, 2006
Reviewed by:	Bill McCarthy		
Subject:	Task 150: Accommodating the Short Term Growth.		

The intent of this memorandum is to summarize the impact of the 2006 through 2009 projected new housing developments on the influent flows to the City of Sultan WWTP, and to identify subsequent action items through which the City can plan and manage this growth.

FORECAST GROWTH AND RESULTING SEWAGE FLOWS

Based on discussion with the City, 249 housing units are currently permitted for construction. Another 396 units are under review and anticipated to be constructed by the end of 2009. It is also anticipated that an additional 52 new commercial Equivalent Residential Units (ERU) would be connected to the sewer system by the end of 2009. The planned WWTP upgrade is currently anticipated to be online by the end of 2008. This Technical Memorandum evaluates how the existing WWTP can be modified to accept flows from the new developments through the winter 2009-2010. This approach is conservative, since all of the new housing constructed may not be occupied by the end of 2009.

Assuming a unit occupation rate of 2.6 person/unit, the sewer system infrastructure will serve up to an additional 648 person in the winter 2007-2008, and an additional 1,677 person by the winter 2009-2010. Table 1 summarizes the flows and loads for the years 2007 and 2009.

Table 1: Summary of Short Term Growth Flows and Loads

	Flow (MGD)			**TSS (lb/day)**			**BOD (lb/day)**		
	2006	**2007**	**2009**	**2006**	**2007**	**2009**	**2006**	**2007**	**2009**
Average Dry Weather Flow and Load	0.24	0.29	0.36	431	516	647	420	503	631
Average Wet Weather Flow and Load	0.36	0.42	0.50	431	516	647	420	503	631
Max Month Flow and Load	0.51	0.58	0.67	492	588	738	516	618	775
Peak Day Flow and Load	1.6	1.7	1.9	755	903	1,133	944	1,129	1,417
% of Average Day, Max Month Design Capacity	**71%**	**80%**	**93%**	**41%**	**49%**	**61%**	**54%**	**64%**	**80%**
Peak Hour Flow and Load	**2.6**	**2.7**	**3.0**						
% of Peak Hour Design Capacity	**118%**	**127%**	**138%**						

COMPLIANCE WITH NPDES PERMIT

The current NPDES permit allows a maximum month flow of 0.72 MGD and a maximum month BOD and TSS load of 1205 lbs/day, and 964 lbs/day, respectively. The flows and loads resulting from the 2009 projected growth are anticipated to remain smaller than the permitted flows and loads. The 2009 projected growth could therefore take place without impacting the NPDES permit compliance.

The plant is anticipated to operate above 85% of its permitted capacity by 2008. The NPDES permit requires that planning for an upgrade be initiated when 85% of capacity is exceeded. The planning effort for the upgrade has already started.

ABILITY OF THE PLANT TO ACCOMMODATE THE SHORT TERM GROWTH

Hydraulic Capacity

Technical Memorandum Task 233 - Hydraulic Capacity Assessment provides a detailed analysis of the hydraulic capacity of each component of the plant. The hydraulic capacity analysis assesses that the plant cannot accommodate the peak hour flow corresponding to the years 2007 and 2009 proposed growth without modifications. The hydraulic bottlenecks for the projected flows are in the influent and effluent pump stations and the UV disinfection channel. The section below summarizes how the plant could be modified to accommodate the year 2009 proposed growth.

The existing influent pump station has a firm capacity[1] of 2.6 MGD, and a total capacity of 3.2 MGD. This is insufficient to provide firm capacity for the 3.0 MGD peak hour forecast flow for the year 2009. Four options are available to address the influent pump station capacity.

(1) Do nothing. The sewer system would store the excess flow if one pump was to fail during a peak flow event. A single pump would pump 1.4 times the peak day flow. Modeling of the sewer system would be required to indicate whether there is adequate storage capacity built in the system to handle the peak hour flow (1.6 times the peak day flow) without risking an overflow at manholes.

(2) Increase Pump Capacity (portable option). Supplement the existing pump station capacity with a portable pump and a quick-connect installation to facilitate connection in case one pump fails during a high influent flow event. The cost of a portable self priming centrifugal pump (Gorman Rupp pump, T Series, 1200 gpm @ 70 ft TDH) mounted on a trailor, and the cost of installing quick-connects into the existing system would be approximately $35,000 to $40,000. The portable pump could be used as a back-up pump at other locations in the sewer system infrastructure.

(3) Improve Pipeline Hydraulics. Change the 8-inch pipe hanging on the SR-2 bridge to a 10-inch pipe, since most of the headloss occurs in the 8-inch section of the pipe. The pump station would then have a firm capacity of 2.7 MGD, and a total capacity of 3.6 MGD. This option does not quite provide the firm capacity of 3.0 MGD. It is unknown whether the storage capacity in the sewer system would accommodate the difference between the peak hour flow (3.0 MGD) and the firm capacity (2.9 MGD) in case one pump was out of service.

[1] A pump station has to be designed for "peak flow and one unit out of service". Per strict interpretation of the Orange Book, the "peak flow" would be the peak hourly flow, however, the latest revision of the Orange Book no longer defines the peak flow. The *firm capacity* of pump station refers to the capacity with the largest unit out of service, and the *total capacity* refers to the capacity with all units in service.

(4) Improve Pipeline Hydraulics and Increase Pumping Capacity. Replace the pumps and change the pipe diameter of the bridge crossing to a 10-inch. The pumps would be selected to provide a firm capacity of 3.9 MGD which is the forecast 2015 peak hour flow.

The influent pump station has a firm capacity that accommodates the 2006 forecast flow. An upgrade would be required by the end to 2007 to accommodate the forecast flows. The only option which provides an adequate firm capacity is Option 4. In order to avoid a potential sunken cost, it is recommended that the decision on the influent pump station upgrade be postponed to late 2006, after the WWTP upgrade Facility Plan is completed and a preliminary layout is available. It is recommended that permitting for modification of the pipe hanging on SR-2 bridge be initiated as soon as possible.

The existing effluent pump station has a firm capacity of 2.3 MGD and a total capacity of 2.7 MGD. It will accommodate the projected peak hour flow for the winter 2006-2007 (2.6 MGD), without redundancy. It will not have the capacity for the 3.0 MGD flow projected for the winter 2009-2010. Proposed options to modify the effluent pump station are described below. The options presented range from the highest risk (Option 1) to lowest risk of overflow (Option 4) at the WWTP in case the pump station could not keep up:

(1) Do nothing. If the pump station is not modified, the plant unit processes would operate under submerged conditions most likely extending upstream to the clarifiers. Submerged conditions are anticipated if the 3.0 MGD peak hour flow occurred at a time when both pumps were in operation and the river water level was above 104 ft (100-year flood level is at 111 ft, low low river water level is at 93 ft). Under this scenario, a good portion of the effluent would bypass disinfection, and the effluent TSS levels would increase due to the submerged operation of the clarifier launders. If the 3.0 MGD peak hour flow occurred when the river level was at the 100-year flood level, the plant unit processes would start overflowing at the clarifiers.

(2) Modify Existing Pumps Impellers. Change out the pump impellers to provide a total hydraulic capacity of 2.8 MGD (with two pumps in operation), under 100-year Flood river level conditions. The pumps with new impellers would have a total hydraulic capacity of 3.0 MGD if the river water level was below 105 ft. If the 3.0 MGD peak hour flow occurred when the river level was at the 100-year flood level (111 ft), the plant unit processes would start overflowing at the oxidation ditch. The cost of changing the impellers is approximately $1,000 per pump. The existing 15 hp motor would remain adequate.

(3) Add a Second Stage to the Existing Pumps. Add a second stage to the existing vertical mixed flow pumps, and change the motor and motor starters. This would provide a firm capacity of 2.6 MGD and total capacity of 3.2 MGD, when the river level is at the 100-year flood level. This upgrade would provide a total capacity in excess of the 2009 projected flows. The firm capacity would be 2.6 MGD or 1.4 times the Peak Day Flow. The cost of adding a second stage is approximately $8,000 per pump, including cost for a new 30 hp motor and cost of installation, and assuming that existing wiring would be adequate. This expense would not be recuperated in the future upgrade.

(4) Increase Pump Capacity (portable option). Supplement the existing pump station capacity with a portable pump and a quick-connect installation to facilitate connection in case one pump fails during a high effluent flow period and high river level period. Under this option, the portable pump would be used whenever the river level rises above 104 ft. The portable unit would be sized for the entire 3.0 MGD peak hour flow, since the head capacity of the existing pumps is too low to pump into the effluent pipeline when the

pipeline and outfall total dynamic head exceeds 35 ft of head (flows above 2.75 MGD would create a headloss in excess of 35 ft). The cost of a portable self priming centrifical pump mounted on a DOT trailor equipped with a floatation device, and the cost of installing quick-connects into the existing system would be approximately $45,000.

(5) Increase Pumping Capacity (new pumps option). Replace the pumps to provide adequate capacity for a flow of 3.9 MGD, which is the forecast 2015 flow. The pumps could then be moved to the upgraded WWTP facility during construction. However the pump selection might not be the best fit if the existing effluent piping and outfall conditions are changed in the upcoming plant upgrade. The cost of changing the two pumps is approximately $15,000 to $20,000 per pump, plus installation cost (approximately $15,000). This expense could be recuperated in the future upgrade, if the new outfall conditions provide an acceptable headloss for the new selected pumps.

Discussion and Decision. After discussion with City staff it was decided that the effluent pump station upgrade should provide a firm capacity of 3.0 MGD. Option 4 and 5 are the only options that would allow for a firm capacity of 3.0 MGD. Option 4 (portable pump) requires a $45,0000 expense. The portable pump will be reusable, however, the re-use potential of such a large unit is questionable. Option 5 requires a $45,000 to $55,000 expense. The equipment can be selected so that it can be re-used in the upgraded WWTP.

The existing UV Disinfection System has adequate disinfection capacity for up to 3.2 MGD. However the current installation of the two banks in series triggers a system headloss higher than the maximum acceptable to avoid flow bypass above the lamps. A flow bypass above the lamps occurs when the effluent level in the channel is higher than 2.0 inches above the top of the upper UV lamp. The high water level is triggered by the headloss through the rack of UV lamps and by the effluent weir. The proposed modification to accommodate existing and short term growth peak hour flows is to move one bank to the parallel channel, and add a new effluent launder weir to the parallel channel. The cost associated with this modification is a labor cost only, and is estimated to be approximately $10,000.

At this time, all other processes are anticipated to accommodate the 2006-2007 projected peak hour flows. However the clarifiers would be operating at their maximum hydraulic capacity by the year 2009. The intermediate pump station, which pumps influent flow from the headworks to the oxidation ditch, will be operating above its firm capacity of 2.4 MGD. Its total capacity is 5.2 MGD. The screw pumps are extremely reliable equipment. Therefore, the City feels comfortable with relying on the total capacity of this pump station as opposed to relying the firm capacity.

Treatment Capacity

Based on design capacity, the plant appears to have sufficient capacity to accommodate the year 2009 projected flows. The on-going plant modeling using Biowin will identify the actual plant capacity and confirm whether the plant can accommodate the projected flows up to year 2009. It will also provide an assessment of the ultimate capacity of the existing plant.

PROPOSED DEVELOPMENT SEWER CONSTRUCTION CONSTRAINTS

The wastewater flow corresponding to the proposed future developments were estimated using Rain Dependent Infiltration and Inflow (RDII) values smaller than in the existing developments. This assumption is based on the fact that the new construction would provide a tighter system than the existing collection system. This will require implementation of the following steps for any future construction:

- Design standards sufficient to ensure tight work.
- Full time inspection to ensure the contractor actually installs joints (e.g. O-rings in PVC pipe), and makes appropriate connections to manholes.
- Acceptance testing by hydrostatic or air tests performed by a specialty contractor under separate contract with the City. Testing should include building connections as well as main line sewers.

RECOMMENDED OF ACTION ITEMS TO ACCOMMODATE THE SHORT TERM GROWTH THROUGH 2009

The City would need to do the following to accommodate the 2009 projected growth (peak hour flow 3.0 MGD):

- Upgrade the effluent pump station: The recommended option is to replace the pumps during the summer 2006 at an approximate cost of $45,000 to $55,000.
- Move one UV bank to the parallel channel during the summer 2006 at an approximate cost of $10,000.
- Ensure that new developments sewer lines have minimal RDII through stringent design and inspection.
- Re-evaluate the influent pump station upgrade in late 2006. A capacity increase is required to accommodate projected peak hour flows prior to the winter 2007-2008.

If you would like to further discuss these findings, please contact Bill McCarthy, or Corinne Jeuch, at 206 624 0100.

Attachment D

September 25, 2006

Mayor Ben Tolson
City of Sultan
PO Box 1199
Sultan, Washington 98294 129795.100

Subject: Sultan WWTP Short Term Hydraulic Improvements
Number of ERUs Clarification

Dear Mr. Tolson:

You requested a clarification on the number of additional sewer connections that would be made available by the proposed Short Term Hydraulic Improvements. This clarification is presented below in three parts: (1) derivation of the available number of ERUs based on the 1997 WWTP design, (2) clarification of the general Sewer Plan and Engineering Report approach to calculating flows per ERU, and (3) how the Engineering Report flows per ERU allow calculating a revised number of ERU available before and after the Short Term Hydraulic Improvements are implemented.

1. Derivation of the available number of ERUs based on the 1997 WWTP design.

The available number of ERUs based on the 1997 WWTP design had been calculated based on the design criteria of a WWTP sized for a population of 4,800 people. Assuming a ratio of 2.6 people per ERU, that gives 1,846 ERUs (=4,800/2.6). The existing served population is approximately 3,315 people with an additional 35 commercial connections (excluding condos and apartments). The combination of the served population and the commercial connections represents 1,313 ERUs currently connected ((3,315/2.6) + 38 = 1,313), which means that 533 connections would still be available. However, these calculations do not account for the higher than anticipated peak hour flows observed at the WWTP.

2. Clarification of the general Sewer Plan and Engineering Report approach to calculating flows per ERU.

The General Sewer Plan and Engineering Report analyzed the wastewater flow data between 2002 and 2005. This analysis, presented in detail in Chapter 4 of the Engineering Report, lead to establishing flows in gallons per day (gpd) per ERU for the existing and future population for the following types of flow:

Table 1: Unit Flows per ERU

	Flow per Existing ERU (gpd)	**Flow per Future ERU between Year 2006 and Year 2010 (gpd)**
Maximum Month Flow Condition	380	254
Peak Hour Flow	1,941	684

Note: The difference between existing ERUs and future ERUs comes from a reduction in I/I.

3. The Engineering Report flows per ERU allow calculating a revised number of ERU available before and after the Short Term Hydraulic Improvements are implemented.

These flows per ERU were then compared to the WWTP capacity as assessed in Appendix B of the Engineering Report. The Sultan WWTP existing capacity was assessed to be as follows with and without the Short Term Hydraulic Improvements:

Table 2: WWTP Capacity Expressed in Million Gallons per Day (mgd) and in Equivalent Residential Units (ERUs)

	WWTP Capacity	Existing ERU	Future ERUs	Total ERUs
Maximum Month Flow Condition (permitted)	0.72 mgd	1,313	867	**2,180**
Maximum Month Flow Condition (after re-rating)	0.74 mgd	1,313	946	**2,259**
Peak Hour Flow Condition Before Short Terms Improvements	2.30 mgd	**1,185** (under capacity)	0	1,185
Peak Hour Flow Condition After Short Terms Improvements	3.2 mgd	1,313	953	2,266

The number of ERUs currently available based on the assessed plant peak hour capacity is 1,185 ERUs (= 2.3 mgd / 1,941 gpd/ERU). Under the current WWTP design, the limiting factor for the plant capacity is the peak hour flow. The Short Terms Improvements were recommended to increase the peak hour flow capacity and allow using the full maximum month condition capacity permitted by DOE.

The anticipated number of ERUs available after the Short Term Hydraulic Improvements are completed is 2,180 ERUs based on the maximum month flow condition permitted by DOE, and 2,259 ERUS based on the maximum month flow capacity of the WWTP that would need to be approved by DOE (see Table 2). The split between the 2,180 ERUs of available capacity at the WWTP is as follows:

- 1,310 ERUs existing,
- 684 ERUs already committed by sewer letters, and
- 183 additional ERUs available after completion of the Short Term Hydraulic Improvements.

After the City submits a re-rating request to DOE, and pending DOE approval, the additional available ERUs would be 262 instead of 183.

The Short Terms Improvements Scope of Work showed 206 ERUs because some commercial ERUs which are residential complexes had been double counted and the re-rated capacity (0.74 mgd) had been used instead of the permitted capacity (0.72 mgd – Correction will be made).

If you need clarification or additional materials, please contact me or Mr. Bill McCarthy with Brown and Caldwell, at (206) 624 - 0100.

Mr. Ben Tolson
September 25, 2006

Very truly yours,

BROWN AND CALDWELL

Corinne Jeuch
Assistant Project Manager

CJ:sjw
Enclosure

cc: Mr. Rick Cisar, City of Sultan
Ms. Connie Dunn, City of Sultan
Mr. Bill McCarthy, Brown and Caldwell

BROWN AND CALDWELL

MEMORANDUM

Project:	Sultan WWTP Upgrade Project		
Project Number:	131877	Date:	March 26, 2007
Prepared by:	Corinne Jeuch	Revised:	
Reviewed by:			
Subject:	Task 411: Hydraulic Capacity Improvements to the Sultan Main Pump Station (Influent Pump Station).		

The Engineering Report recommended that the Influent Pump Station be upgraded during the Summer 2007. The objective of this Memo is (1) to document the decision made to postpone the Influent Pump station Upgrade to the Summer 2008, and (2) to present the decision that will need to be made by the end of 2007 regarding the Sultan River crossing.

Decision to postpone the Influent Pump Station upgrade to the Summer 2008.

The following two sections provide the background necessary to understand why the Influent Pump Station upgrade can be postponed to 2008.

Why do we need to upgrade the Influent Pump Station prior to the WWTP Upgrade?
As discussed under the Short Terms Improvements discussion in the Engineering Report, the existing influent pump station has a firm capacity[2] of **2.6 MGD**, and a total capacity of 3.2 MGD. This is insufficient to provide firm capacity for the 3.0 MGD peak hour forecast flow for the year 2009. Therefore an upgrade to the existing influent pump station is required prior to the main plant upgrade referred to as the "WWTP Upgrade Project Phase 1" and planned to be on line by the end of 2009.

Do we need to upgrade the Influent Pump Station in 2007 or 2008? Has the growth in 2006 been what was projected?
The Engineering Report assumed that the population growth between the end of 2005 and the end of 2007 would be 645 new people (or 248 new residential connections), 20 new commercial connections, and an extension of the sewer service area of 50 acres.
The growth has in fact been slower than forecast. During a meeting with City Staff on March 23, 2007, the growth between the end of 2005 and the end of 2007 was estimated to be 120 residential ERUs, no commercial ERUs, and no extension of the sewer service area (equivalent to the City limits).

[2] A pump station has to be designed for "peak flow and one unit out of service". The *firm capacity* of pump station refers to the capacity with the largest unit out of service, and the *total capacity* refers to the capacity with all units in service.

Table 1: Growth Projections and Peak Hour Flows

	Engineering Report Assumption		Actual Projected Growth as of March 23, 2007	
Year	2005	2007	2005	2007
Population served (pers)	3,315	3,960	3,315	3,560
Commercial ERUs (x2.6 = pers)	36	59	38	38
Sewer Service Area (acres)	650	700	650	650
Peak Hour Flow (mgd)	2.54	2.75	2.54	2.58

Based on the revised growth projection, as of March 23, 2007, the influent pump station is anticipated to have adequate capacity through the winter 2007-2008. The influent Pump Station upgrade is therefore postponed to the spring 2008, to allow for a better understanding of the Sultan River crossing prior to designing the upgrade.

Decision Regarding the Influent Pipeline Sultan River Crossing.

In order to proceed with the design of the Influent Pump Station upgrade, a decision needs to be made by December 2007, on which assumption to make regarding the future modifications to the influent pipeline Sultan River crossing. The following two sections provide the background necessary to understand why the future influent pipeline modification has an impact on the 2008 Influent Pump Station design, even though it would happen only around the Year 2012.

Proposed Influent Pump Station Upgrade phases.

In order to spread out the expenses for the influent pump station capacity increase, an upgrade in three phases is proposed:

1. The "Short Term Improvements" phase (to be completed prior to the Fall 2008): The Upgrade will consist of installing two new pumps (one duty, one standby) with VFDs. This capacity increase will accommodate, at the minimum, the year 2010 flows;

2. The "WWTP Upgrade Project Phase 1" (to be completed by the end of 2009): The Upgrade will consist of installing a third new pump, similar in size to the ones installed in the previous Phase for a total of two duty pumps and one standby. This capacity increase will accommodate, at the minimum, the year 2029 flows;

3. The Influent Pipeline Sultan River Crossing Upgrade (to be completed around Year 2012): The upgrade will consist of replacing the existing 8-inch diameter pipe hanging on the SR-2 Bridge with one of the following two options:

   Option a: Replace with a 10-inch diameter pipe on the same bridge (maximum load allowable after the water pipe stops being used),

   OR

   Option b: Replace with a 12-inch diameter pipe under the Sultan River using the same directional drill casing as the planned future water pipe.

The impact of the influent pipeline upgrade option on the Influent Pump Station upgrade design.

Even though the influent pipeline modification does not need to occur for another few years, the option selected for this future upgrade has an impact on the design that needs to happen for the "Short Terms Improvements" phase.

If "Option a" is selected, the headloss in the pipe between the pump station and the WWTP will be significantly greater than if "Option b" is selected. The new pumps planned to be installed during the "Short Terms Improvements" phase will be sized to handle pumping scenarios before and after the influent pipeline modification, assuming one of the two influent pipeline modification options is implemented.

For instance, if "Option a" is selected, the pumps will be approximately 90 hp each, whereas if "Option b" is selected, the pumps will be approximately 60 hp each.

The decision regarding the Sultan River crossing can be summarized as follows:

- **If the future influent pipeline modification is <u>known</u>, then the design will be based on the City selected option.**
- **If the future influent pipeline modification is <u>unknown</u>, then the design will be based on the worst case scenario, which is "Option a" (10-inch diameter pipe on the SR-2 Bridge).**