King County

1200 King County Courthouse
516 Third Avenue
Seattle, WA 98104

KING COUNTY

Signature Report

October 2, 2007

Motion 12585

Proposed No. 2007-0457.1 **Sponsors** Phillips, Ferguson, Lambert and Hague

A MOTION authorizing the executive to provide technical assistance to the Washington state Department of Ecology, the cruise ship industry and the Port of Seattle as they discuss options for beneficially using solids residuals generated by the marine cruise ships that visit local port facilities.

WHEREAS, the King County council passed Motion 12498 on April 9, 2007, that directed the King County executive, through the wastewater treatment division of the department of natural resources and parks, to work cooperatively with the Port of Seattle and other affected agencies to undertake a study of the potential for processing marine cruise industry-generated wastewater through the county's wastewater treatment system, and

WHEREAS, the wastewater treatment division has completed said study, as attached to this motion, and has concluded that treated wastewater discharged from cruise ships with advanced wastewater systems operating in Washington is at least as clean as treated wastewater discharged from the county's West Point treatment plant, and

WHEREAS, the wastewater treatment division has also concluded that the management of partially-treated solids residuals from the wastewater treatment process aboard cruise ships, also referred to as "biomass" by the cruise ship industry, appears to provide an opportunity for beneficial use rather than discharge beyond twelve nautical miles from shore, and

WHEREAS, the Department of Ecology, the cruise ship industry, and the Port of Seattle conducted their annual Memorandum of Understanding meeting on December 8, 2006, and recommended that a work group be formed to discuss options for managing biomass from cruise ships for beneficial use;

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

A. That the King County executive, through the wastewater treatment division of the department of natural resources and parks, continue to work cooperatively with the state Department of Ecology, representatives of the cruise industry and the Port of Seattle, to provide technical assistance as they discuss options for managing biomass from cruise ships; and

B. That the executive keep the council apprised of progress made by all parties as they discuss management options for biomass from cruise ships.

Motion 12585 was introduced on 9/17/2007 and passed by the Metropolitan King County Council on 10/1/2007, by the following vote:

Yes: 9 - Mr. Gossett, Ms. Patterson, Ms. Lambert, Mr. von Reichbauer, Mr. Dunn, Mr. Ferguson, Mr. Phillips, Ms. Hague and Mr. Constantine
No: 0
Excused: 0

KING COUNTY COUNCIL
KING COUNTY, WASHINGTON

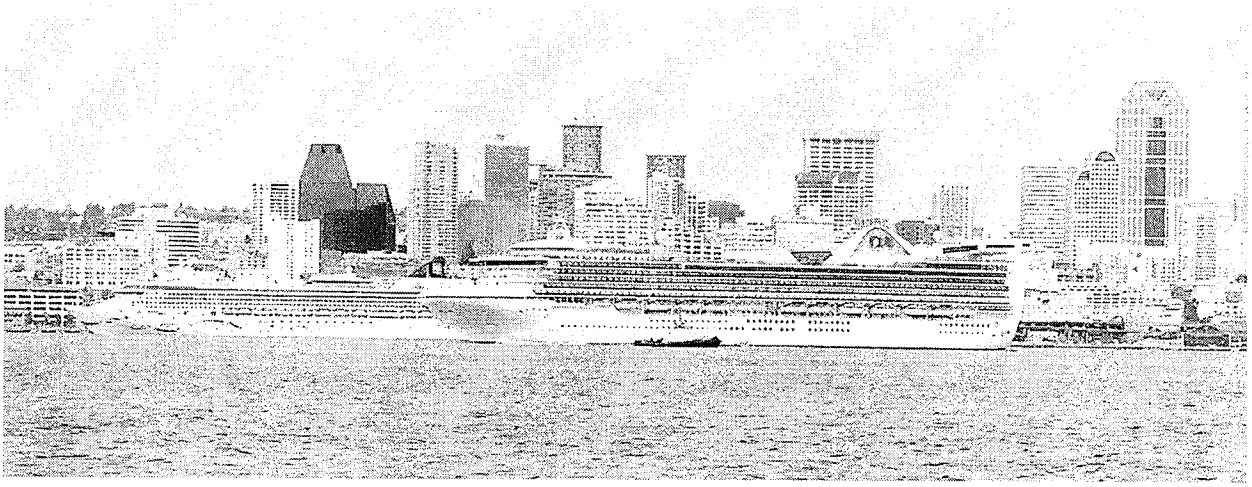
Larry Gossett, Chair

ATTEST:

Anne Noris, Clerk of the Council

Attachments A. Cruise Ship Wastewater Management Report August 2007

ATTACHMENT A
12585



Cruise Ship Wastewater Management Report

August 2007

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

ATTACHMENT A
12585

Cruise Ship Wastewater Management Report

August 2007

King County

Department of Natural Resources and Parks
Wastewater Treatment Division
King Street Center, KSC-NR-0512
201 South Jackson Street
Seattle, WA 98104
http://dnr.metrokc.gov/wtd/

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206-684-1242 TTY Relay: 711

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1 Executive Summary

In April 2007, the King County Council passed Motion No. 12498, which directed the Wastewater Treatment Division to work cooperatively with the Port of Seattle and other affected agencies to undertake a study of the potential for processing marine cruise industry-generated wastewater through the county's wastewater treatment system. The Council's Motion directed that the following elements be included in the study:

- Impacts to the environment that can be avoided through the diversion, of waste from cruise ships through the county's wastewater management system;
- The capacity of the county's wastewater treatment system to receive and process the volumes of waste generated by the marine cruise ships which visit local port facilities, now and in the future;
- A summary of piping, coupling and other mechanisms needed to channel waste from visiting cruise ships to the county's wastewater management system;
- Any displaced future opportunity for wastewater processing capacity utilization by resident users of the wastewater management system;
- Costs for waste diversion, and any appropriate financial arrangements to address costs;
- Economic or other impacts to the cruise ship industry; and
- A recommendation regarding any appropriate council action.

1.1 Summary of Findings & Conclusions

To address each element of the Council's Motion, the Wastewater Treatment Division gathered information about how the cruise ship industry currently manages wastewater; and evaluated the capacity, potential environmental benefits, and costs to the cruise industry of processing cruise ship waste within the regional wastewater system. The following findings and conclusions are based on these information gathering and analytical tasks:

1. There is no identified benefit of channeling wastewater from cruise ships to the regional conveyance and treatment system. The cruise industry actively treats wastewater aboard their cruise ships. Most cruise ships operate advanced wastewater treatment systems (AWTS). Based on a review of effluent sampling results prepared by the State Department of Ecology, and on a comparative analysis of effluent samples from some cruise ships with effluent produced at the West Point Treatment Plant, the cruise ships sampled are producing and discharging effluent that is at least as clean as effluent from West Point.
2. The partially-treated solids residuals from the wastewater treatment process aboard cruise ships, also referred to as "biomass" by the cruise industry, could be managed in a more environmentally beneficial manner. The South Treatment Plant could receive and incorporate biomass into the existing treatment process without any expansion or modification of the South Treatment Plant. King County recycles all of its biosolids.

3. Though not necessary, it is technically feasible to construct piping, coupling and other mechanisms needed to channel waste from visiting cruise ships to the county's wastewater management system. The estimated capital cost for making these improvements is approximately $3-million. This capital cost estimate does not include costs that the cruise industry would have to absorb for retrofitting their ships to be compatible with any piping and coupling equipment that would be constructed by the county. Additional ongoing operational and maintenance costs for any infrastructure constructed to channel waste from visiting cruise ships to the county's wastewater management system have also not been calculated.
4. Accepting biomass from cruise ships at the South Treatment Plant will not result in displacing any future opportunity for wastewater processing capacity utilization by resident users of the wastewater management system. Other feasibility issues, including the possible need to retrofit of ships to offload biomass to shore, and odor control during the offloading process require additional investigation.
5. No preliminary costs for treating biomass that could be trucked to the South Treatment Plant have been calculated for this study. The Department of Ecology, representatives of the cruise ship industry, and the Port of Seattle have committed to discuss options for managing biomass. Once they begin, information developed for the use options can be used to estimate costs for managing biomass. Appropriate financial arrangements for addressing costs can also be developed.
6. A change in management practices that involves off-loading biomass from cruise ships for treatment will represent a change in management practices. This could have economic and operational impacts to the cruise lines because it would involve employing a trucking operation to off-load and transport biomass to the South Treatment Plant. Additionally, the cruise lines would have to pay the cost of discharge and treatment at the South Plant. Therefore, costs would be incurred by the cruise lines for each port call at the Port of Seattle if biomass was off-loaded for additional treatment. It is anticipated that these cost impacts will be further defined and quantified as the Department of Ecology, the cruise lines, and the Port discuss other management options.
7. It is recommended that the Council direct the Wastewater Treatment Division to continue to work cooperatively with the Department of Ecology, the cruise lines, and the Port of Seattle and provide technical assistance as they work to develop biomass management options. The timeline for developing management options should be governed by the entities party to the Memorandum of Understanding; the Department of Ecology and the cruise lines, and the Port of Seattle.

1.2 Analytical Report Contents

What follows is the complete analytical report that provides an overview of cruise shipping activity through the Port of Seattle, outlines the information gathered to study the potential for processing marine cruise industry-generated wastewater through the county's wastewater treatment system, and addresses each study element identified by the County Council' Motion.

2 Cruise Shipping in Puget Sound

Cruise shipping is a growing industry in Seattle. The primary destination for cruise ships home-ported in Seattle is Alaska. According to the Port of Seattle nearly 200 cruise ship visits accommodating approximately 750,000 passengers will occur during the 2007 cruise season. The cruise ship season typically runs from April into September of each year. These numbers are significantly larger than the 6 cruise ship visits that accommodated 6,600 passengers in 1999. At present, ships arrive and depart on Fridays, Saturdays, and Sundays during the cruise season. The number of ship calls and the length of the cruise season have the potential to expand over time as the popularity of cruising grows.

3 Port Facilities for Cruise Shipping

In 2007, the cruise lines operating at port facilities are Norwegian Cruise Line, Royal Caribbean, Celebrity Cruises, Holland America Line, Princess Cruises, and America West. Norwegian Cruise Line, Royal Caribbean and Celebrity Cruises homeport at the Bell Street Pier Cruise Terminal at Pier 66. Holland America Line and Princess Cruises will homeport at the Terminal 30 Cruise Facility.

The Port of Seattle has plans to move their cruise shipping operations at Terminal 30 to Pier 91 near Magnolia by April of 2009. This Study looks at the feasibility of processing marine cruise industry-generated wastewater from ships that would utilize Pier 91. The Study focuses on Pier 91 because it allows for the incorporation of wastewater offloading infrastructure to be incorporated into the design and construction of the new cruise terminal. In turn, this allowed for the most favorable analysis of the costs associated with providing off-loading services. Figure 1 shows the location of the planned new cruise terminal in relation to the county's existing wastewater conveyance facilities.

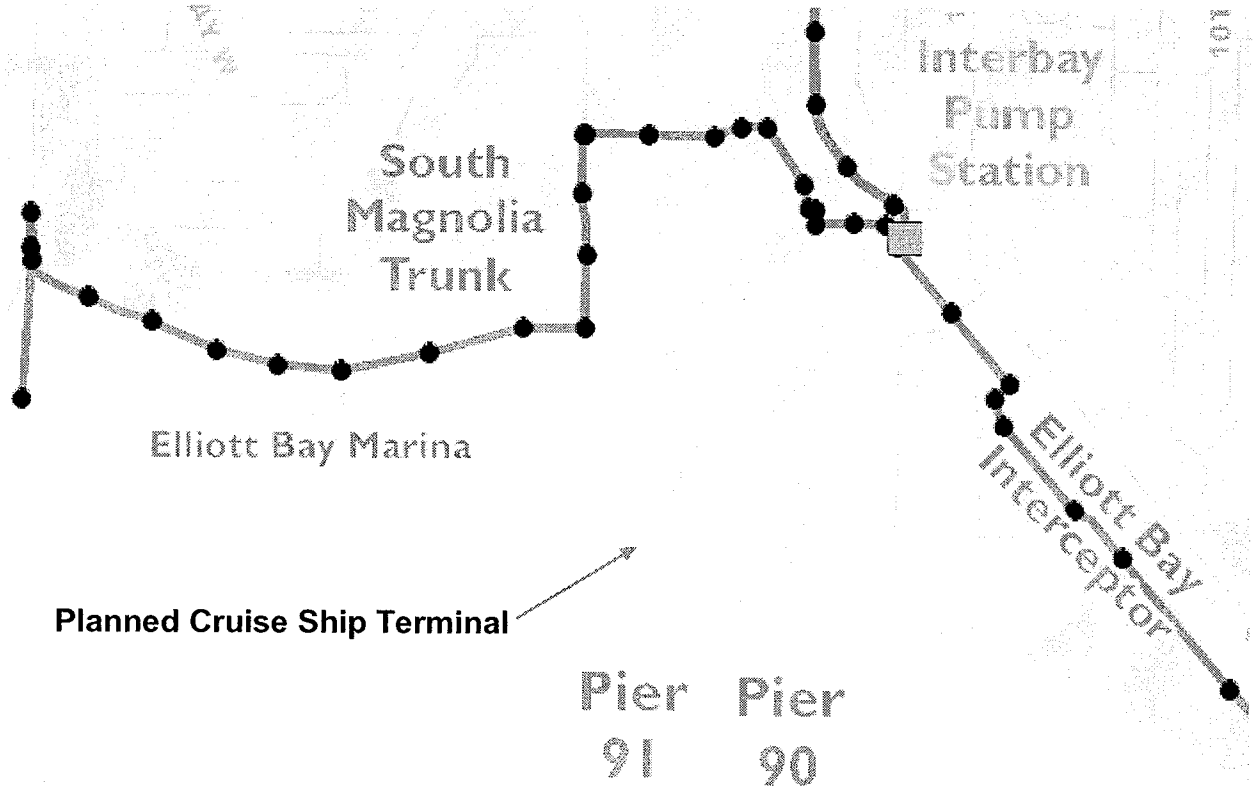

Figure 1. Map of Wastewater Conveyance Facilities Near Pier 91

4 Overview of Cruise Ship Wastewater Management Operations

Cruise ships that operate in Seattle typically offer seven day cruises to Alaska. A large cruise ship will use about 300,000 gallons of potable water per day, for drinking, washing, food prep, wastewater flushing, laundry, etc. Ships with fewer passengers and crew, of course, use less. A cruise ship's waste water consists of both "gray" and "black" water. Graywater comes from cabin sinks and showers, laundering, galley sinks, air conditioning condensate, and salon sinks. Blackwater is wastewater from toilets and medical facility sinks.

Gray and black water is processed through the ship's wastewater treatment system. The treated water is discharged overboard when permitted at a rate of approximately 13,000 gallons per hour. As cruise ships treat their wastewater, they have the capacity to hold treated effluent for one to two days if they are not permitted to discharge in inland waters (see Section 5). No cruise ship has the ability to hold an entire weeks worth of untreated wastewater. Cruise ships have a nominal amount of wastewater storage capability, but this is typically held empty in case a ship's wastewater treatment system experiences any problems or upsets. Constant discharge of treated effluent is also necessary to maintain proper trim and stability of the ship, and to accommodate fuel and potable water storage. During a seven day cruise to and from Alaska, cruise ships spend most of their time outside of Washington waters. This means that most wastewater produced on a

cruise ship traveling between Seattle and Alaska is treated and discharged while the ship is outside of the State and Puget Sound.

All cruise ships have wastewater treatment systems on board for their gray and black water. There are primarily two types of wastewater treatment systems on board cruise ships; marine sanitation device (MSD) systems or advanced wastewater treatment systems (AWTS). Some ships have unique wastewater treatment systems that are more advanced than MSD systems but pre-date (technologically) AWTS systems. MSD systems are an older technology that is being phased out of use within the cruise industry. They are a two-stage treatment system that consists of bio-reaction and disinfection of wastewater with chlorine prior to discharge. Advanced Wastewater Treatment Systems are rapidly becoming the standard type of treatment system on cruise ships. These systems typically consist of a multi-stage treatment process that includes filtration of solids, bio-reaction, ultra-filtration to remove remaining solids, and disinfection of wastewater with ultra-violet light prior to discharge.

5 Oversight of Cruise Shipping in Washington

Most cruise ships that operate in Seattle are members of the Northwest Cruise Association (NWCA). According to information provided by the Department of Ecology, all large cruise ship port calls in 2006 were made by NWCA-member cruise lines. In 2007, 15 of 16 ships that will visit the Port of Seattle during the cruise season belong to the NWCA. According to the Port of Seattle's cruise schedule, the one non-member ship is scheduled to have only 2 visits during the season.

NWCA-member ships that operate in Seattle are subject to a Memorandum of Understanding (MOU) between the Department of Ecology, the NWCA, and the Port of Seattle and that establishes, among other things, operational practices for the management of wastewater for cruise ships operating within Washington waters. The MOU prohibits the discharge of untreated black or gray water from cruise ships within the State. It also sets standards and a process for receiving permission to discharge treated effluent within Washington waters. Figure 2 shows the waters subject to the MOU.

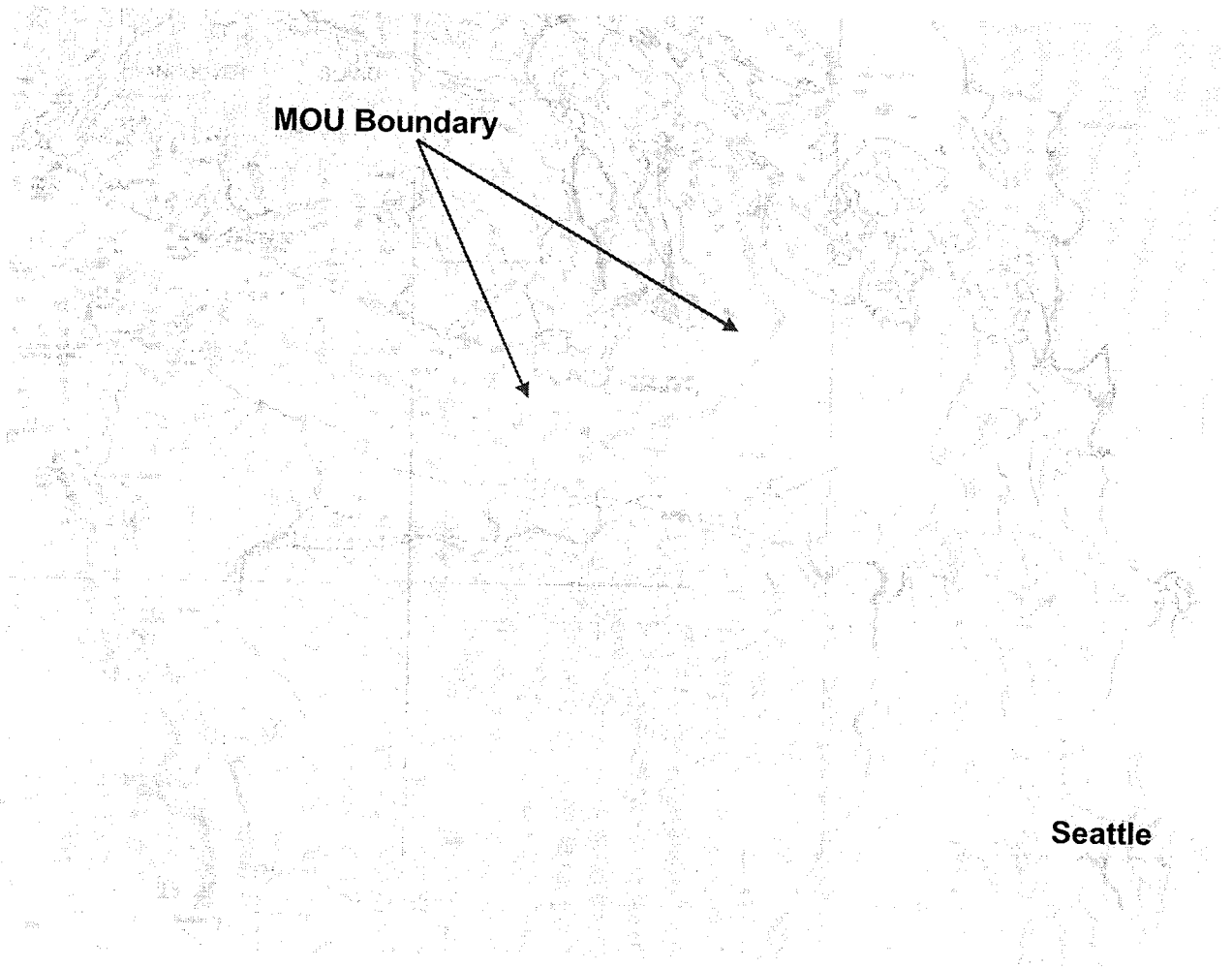

Figure 2. Navigational Chart of Northwest Washington Waters Subject to the Cruise Operations MOU

According to Section 2.1, Wastewater Management, of the MOU, each cruise ship must provide the following information in order to receive permission to discharge treated effluent within the State. To receive discharge approval at one nautical mile at 6-knots, cruise ships must provide the following:

- Documentation on the type of treatment system in use on the ship including schematic diagrams of the system.
- Documentation that the system is certified by the United States Coast Guard for continuous discharge in Alaska[1]. If the certification has not yet been provided by the Coast Guard at the time the other documentation is submitted to Ecology, it may be submitted less than 60 days prior to commencement of discharge but in no event less than 30 days prior to commencement of discharge.

[1] The State of Alaska employs higher standards and testing regimes for cruise ships than what is possible in the State of Washington. This is because only the State of Alaska has a specific authority in the Federal Clean Water Act to enact regulatory standards for cruise ships. Though not specifically addressed in the MOU, Canadian law does not allow cruise ships to discharge untreated wastewater in Canadian waters. All Cruise ships are subject to Canadian law while operating in their waters.

To receive approval for continuous discharge cruise ships must provide the information listed above as well as the following:

- Provision for daily twenty-four hour continuous turbidity or equivalent monitoring of the quality of the effluent generated by the AWTS.
- Documentation of system design that demonstrates the AWTS can be automatically shut down if monitoring of treated effluent indicates a system upset; or documentation that demonstrates that operational controls exist to insure system shut down if monitoring of treated effluent indicates a system upset. An example of an acceptable operational control is a system that has the continuous monitoring device alarmed as to immediately alert engineering staff on watch to shut down overboard discharges from the system in the event of high turbidity levels in the treated effluent.
- Documentation that all treated effluent will receive final polishing with ultraviolet (UV) light immediately prior to discharge.
- Copies of water quality tests results taken from the AWTS effluent during the preceding six months.
- A vessel specific plan that: identifies how effluent will be stored until the AWTS is repaired and which indicates the storage capacity of holding tanks; and includes a notification protocol for notifying Ecology of system shut down which occurs while within waters subject to this MOU.

Any cruise ship approved for discharge from an AWTS in waters subject to the MOU agrees to:

a. Sample the quality of the treated effluent[2] using a Washington state-certified laboratory at least one time per month while at port in Washington during each cruise season using the sampling requirements established per the United States Coast Guard, Captain of the Port, Southeast Alaska Policy for conventional pollutants continued compliance monitoring regime and as referenced in *Appendix vi*. Parameters sampled include pH, Biochemical Oxygen Demand (BOD), Fecal Coliform, Total Suspended Solids (TSS), and Residual Chlorine (RC).

b. Meet the limitations on discharge as set in Alaska regulations for BOD, TSS, pH, Fecal Coliform and Residual Chlorine[3].

c. Split samples with Ecology upon Ecology's request when sampling is conducted in Washington waters.

d. Conduct Whole Effluent Toxicity (WET) Testing once every two years for vessels homeported[4] in Washington and once every 40 port calls or turnarounds to a port in Washington for all other vessels.

[2] Samples are obtained from a test port in the wastewater discharge line in order to ensure that samples are representative of treated effluent that is actually being discharged.

[3] For the MOU, there is a presumption that meeting Alaska's standards means that Washington's Water Quality Standards are likely being met and that if Alaska's standards are not being met, Washington's Water Quality Standards are not being met.

[4] The MOU defines "homeported vessel" as a vessel that makes a call or does a turnaround at a port in Washington at least 20 times per year.

e. Provide Ecology with duplicates of test results obtained for and provided to the State of Alaska to enable Ecology to monitor the quality of the effluent from such systems.

f. Notify Ecology at least a week in advance of sampling and to allow Ecology staff access to the ship in order to observe sampling events.

g. Notify Ecology if any material changes are made to the system.

When a cruise ship is not equipped with AWTS equipment, or when a ship has not requested and received permission to discharge treated effluent within waters subject to the MOU, the ship must discharge its treated effluent outside of Washington waters, which is typically beyond twelve nautical-miles from shore. In no case is a cruise ship allowed to discharge untreated wastewater. Table 1 below summarizes the ships scheduled to make port calls in Seattle this year, and whether or not they have received permission, as of the date of this report, to discharge effluent in Washington waters. As can be seen in Table 1, only four vessels are allowed to discharge in Washington waters during the 2007 cruising season. All other ships are discharging at least 12 miles off-shore at a minimum allowable speed of 6-knots. Typically, cruise ships travel at 18 to 20 knots.

Table 1. 2007 Commercial Passenger Vessel Association & Discharge Status

Cruise Line	Vessel Name	Passenger Capacity	Number of Port Calls	Approved for Discharge in Washington[3] ≥ 1m from berth and ≥ 6 knots		Approved for Discharge In Washington' continuously (at or within 1 nm of berth)	
				BW[1]	GW[2]	BW	GW
Celebrity Cruises	*MERCURY*	2779	16	NO	NO	NO	NO
Celebrity Cruses	*SUMMIT*	3409	1	NO	NO	NO	NO
Holland America	*AMSTERDAM*	2027	20	NO	NO	NO	NO
Holland America	*NOORDAM*	2718	21	NO	NO	NO	NO
Holland America	*OOSTERDAM*	2648	21	NO	NO	NO	NO
Holland America	*ZAANDAM*	2107	1	NO	NO	NO	NO
Holland America	*ZUIDERDAM*	2648	1	NO	NO	NO	NO
Norwegian Cruise Lines	**NORWEGIAN PEARL**	**4230**	**20**	**YES**	**YES**	**YES**	**YES**
Norwegian Cruise Lines	**NORWEGIAN STAR**	**4000**	**22**	**YES**	**YES**	**YES**	**YES**
Princess Cruise Line	**GOLDEN PRINCESS**	**3660**	**21**	**YES**	**YES**	**YES**	**YES**
Princess Cruise Line	**SUN PRINCESS**	**2820**	**21**	**YES**	**YES**	**YES**	**YES**
Royal Caribbean	*RADIENCE OF THE SEAS*	3360	1	NO	NO	NO	NO
Royal Caribbean	*SERENADE OF THE SEAS*	2960	2	NO	NO	NO	NO
Royal Caribbean	*VISION OF THE SEAS*	3200	19	NO	NO	NO	NO
Regent Cruises	*SEVEN SEAS MARINER*	1200	1	NO	NO	NO	NO
NON Northwest Cruise Ship Association Vessels							
American West	*EMPRESS OF THE NORTH*	320	2	NO	NO	NO	NO

[1]BW = Blackwater

[2]GW =Graywater

Ships w/ Ecology approval to discharge to Washington waters in 2007

The MOU does have limitations. Compliance with the MOU is voluntary. It also only applies to cruise ships that are members of the NWCA and make port calls in Washington. Any enforcement actions are via federal law, State of Washington Water Quality Standards, or the Revised Code of Washington.

6 Cruise Ship Effluent Analysis

For this study, the county analyzed the quantity and quality of cruise ship effluent in relation to the effluent produced at the West Point Treatment Plant that is discharged in Puget Sound; and, reviewed previous studies of discharged cruise ship effluent. The purpose of these tasks was to identify and quantify the impacts to the environment that can be avoided through the diversion, of wastewater from cruise ships through the county's wastewater management system. The analysis consisted of the following:

- Obtaining information about the amount of effluent treated and discharged by cruise ships and calculating how much effluent is discharged to receiving waters in Washington;
- Reviewing cruise ship effluent tests conducted by the Department of Ecology in 2006;
- Collecting effluent samples from two cruise ships and comparing them with effluent samples collected at the West Point Treatment Plant;
- Reviewing a study entitled *The Impacts of Cruise Ship Wastewater Discharge on Alaska Waters* prepared by a Science Advisory Panel convened by the Alaska Department of Environmental Conservation.

6.1 Cruise Ship Effluent Volumes

Information provided by the cruise ship industry shows that large cruise ships that operate AWTS systems generate approximately 180,000 gallons of effluent from the treatment of gray and blackwater on a daily basis. As shown in Table 1 above, only four of fourteen ships currently home ported in Seattle have permission to discharge treated effluent in Washington waters, which includes Puget Sound. The cruise ships operating in Seattle spend at most 24 hours in Washington waters at the beginning and again at the end of their seven-day cruises coming into port, exchanging passengers and heading out of port to Alaska. As discussed above, cruise ships permitted to discharge effluent in Washington waters are capable of discharging at a rate of approximately 13,000 gallons per hour. It is then theoretically possible for a cruise ship to treat and discharge 360,000 gallons of treated effluent into Washington waters during a seven-day cruise. This calculation should be viewed as a ***conservatively high estimate*** because it assumes a maximum amount of time that a cruise ship will actually spend in Washington waters; assumes that a greater number of ships (4) would be in Washington waters than there are available docking spaces (3); and, also does not account for likely reductions in wastewater generation while a ship is in port and passengers are departing and boarding each ship. A more accurate calculation of the volume of effluent from cruise ships discharged to Puget Sound waters within the county is difficult to calculate because ships move at different speeds under varying conditions of weather, schedule, and the number of other ships operating in the area. However, the volume of wastewater discharged into Washington waters by a cruise ship during a seven day cruise would likely be much less than the 360,000 gallon estimate calculated above.

The daily volume of treated effluent produced and discharged by a cruise ship is much smaller in relation to the average volume of effluent discharged daily by the West Point Treatment Plant. West Point produces and discharges approximately 91-million gallons a day during the April through September cruise season. As stated above, a cruise ship could generate and discharge approximately 180,000 gallons of effluent a day, or less that two-tenths of one-percent of the average daily output of West Point.

6.2 Summary of Cruise Ship Effluent Tests Conducted by the Department of Ecology in 2006

As a part of the MOU between Ecology, the NWCA, and the Port, Ecology annually assesses the performance of cruise ships operating in Washington for environmental impacts during the cruise season. Per the MOU, Ecology received and analyzed two Whole Effluent Test (WET) samples from cruise ships in 2005 and four in 2006[5] as well as conducting MOU compliance sampling. Ecology reported their test results in a report entitled "*2006 Assessment of Cruise Ship Environmental Effects in Washington*". In their 2006 Assessment, Ecology concluded that the "majority of the lines and vessels operating with the MOU had a successful season and were in compliance throughout". The sampling results continued to "show excellent effluent quality".

Ecology's tests found that while the sampling results were in compliance with the Washington MOU and Alaska limits, the results would have violated Washington's water quality standards for pH, and chlorine residual at the point of discharge. However, it must be noted that discharge of effluent from the cruise ships does not account for a mixing zone. On-land sewage treatment plants have mixing zones. Accordingly, Ecology reported that a group of toxicity testing experts, cruise line representatives, Port of Seattle staff, and Ecology staff will begin evaluating testing protocols and guidelines. Still, Ecology concluded that the "results from the cruise ships are of a far better quality than most of the on-land [treatment] plants".

Ecology's complete 2006 Assessment can be viewed at
http://www.ecy.wa.gov/pubs/0710029.pdf

6.3 Comparative Evaluation of Cruise Ship Effluent Samples with Effluent Samples from the West Point Treatment Plant

On July 1, 2007 Wastewater Treatment Division staff collected two grab samples[6] of effluent from cruise ships docked at the Port of Seattle's Terminal 30 and Terminal 66. Each ship operates AWTS treatment systems. Grab samples were taken from the effluent discharge lines of each ship. The samples were transported to the lab at the county's West Point Treatment Plant for testing.

[5] The MOU requires WET testing once every two years for homeported vessels (20 or more calls/turnarounds per season) and once per forty port calls or turnarounds for all other vessels.

[6] Grab samples are samples taken from a single point in a treatment process at a specific time. Test results represent a snapshot of the quality of effluent being produced by treatment process. Grab samples are commonly used for testing by the wastewater treatment industry, including the county's Wastewater Treatment Division.