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Washington State Ferries Financing Study II

Auto-Passenger Vessel Preservation and Replacement
Draft Report

Prepared For:
Joint Transportation Committee
Washington State Legislature

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Executive Summary

This review of Washington State Ferries' (WSF) vessel preservation and replacement program is being conducted for the Joint Transportation Committee (JTC) pursuant to budget provisos adopted by the 2007 legislature. The budget provisos direct the JTC to review vessel preservation costs and to make recommendations regarding the most efficient timing and sizing of future vessel acquisitions beyond the currently authorized four new 144-car vessels.

Auto-Passenger Vessels and Condition

Class and age. WSF owns and operates 24 auto-passenger vessels to serve nine routes on Puget Sound and the San Juan Islands. These vessels fall into six distinct classes, reflecting when they were built: four (4) Steel Electric class, built in 1927; three (3) Evergreen State class, built in 1954-59; four (4) Super class, built in 1967; two (2) Jumbo Mark I class, built in 1972; six (6) Issaquah class, built in 1979-82; and three (3) Jumbo Mark II class, built in 1997-98. In addition, WSF has two (2) miscellaneous class vessels: the *Hiyu*, acquired in 1967, and the *Rhododendron*, built in 1947.

Although eight vessels are between 48 and 80 years old, 72 percent of riders are on routes that are served by vessels 40 years old or newer.

Use and capacity. WSF actively uses 21 of these vessels, assigning 16 to a specific route year-round, and five to maintenance relief at least part of the year. The other three vessels are on stand-by to be available for unanticipated service needs and are not crewed. The three inactive vessels are not included in the WSF capital preservation -budget.

WSF's *Draft Long-Range Strategic Plan 2005-30* found the constraint on the system is capacity for autos. The total auto capacity for the 21 vessels in active service is 2,672 cars. The oldest two classes of vessels carry fewer than 100 cars each. The three newest classes of vessels carry 188, 124 and 202 cars respectively.

Condition. To track vessel performance and condition, WSF identifies a life cycle rating for vital and non-vital systems. This rating is the percentage of a vessel's systems that are operating within their life cycle at a particular point in time, weighted by the cost of replacement. Almost all the 21 active vessels have a high percentage of vital systems operating within or near the performance goal of 90 percent operating within their life cycle. The exception is the *Hyak,* a Super class vessel not rebuilt when the others in this class were rebuilt between 1991 and 2000. It is important to note that the life cycle rating does not measure the condition of the hull steel.

WSF's fleet planning assumes that each vessel will be out of service on average six to eight weeks per year for maintenance and capital preservation. This means that, on average, nearly two vessels are out of service per day.

The consultants conducted a visual inspection and tour of auto-passenger ferries, interviewed WSF staff, and reviewed the life cycle cost model and WSF's reports and

plans for these vessels. The consultants' conclusions on the vessels' condition are as follows.

- ***Steel Electric class and Rhododendron (built 1920s and 1940s):*** These are WSF's oldest auto-passenger ferries. While they have 90 percent or more of vital systems operating within their life cycle, these vessels have experienced steel deterioration problems in the hull that are not reflected in the life-cycle rating. The United States Coast Guard (USCG) has required that all concrete ballast be removed from the Steel Electric class vessel hulls to allow for complete inspection. The Steel Electric class vessels were pulled from service under emergency conditions in November, 2007.
- ***Evergreen class (built 1950s):*** Two of the three vessels were upgraded in 1995 with new machinery and controls. These two are in good shape for their age. For the most part they have been well maintained. However, in at least one, the bilges are dirty, oily, and in some places, corroded. Although renovated in 1988, the third vessel (*Evergreen State)* is in need of new engines and propulsion control system. The cost to upgrade now seems unwarranted since the *Evergreen State* is 53 years old, and WSF has a 60-year planned life for its vessels.
- ***Super class (built 1960s):*** Three of the four vessels are in good condition for their age and appear to have been well maintained. However, as with the Evergreen State class vessels, in at least one of the Super class vessels the bilges are dirty, oily, and in some places, corroded. The fourth, the *Hyak,* was not rebuilt when the others were, and consequently has the lowest percentage of vital systems operating within life cycle of any active vessel. Since there are 20 more years of life for this vessel, the expense to upgrade it may be cost-effective.
- ***Jumbo Mark I (built 1970s):*** These two vessels are in good condition and have been well maintained. However, there are signs of corrosion in the bilges and in curbing outboard on the main deck. One of the vessels (the *Walla Walla)* has only 60 to 78 percent of vital systems operating within life cycle, but is due for major work in 2021-23.
- ***Issaquah class (built 1980s):*** These six vessels are operating at or near WSF's goal for vital systems, except for the *Chelan,* which is due for a major overhaul in 2021-23. A tour of two of the vessels revealed that additional bilge maintenance is needed.
- ***Jumbo Mark II (built 1990s):*** These three vessels are in excellent condition.
- ***Hiyu (built 1967):*** This is the fleet's smallest vessel, now on inactive status. Despite her 40-year age, the vessel is in very good condition. Though limited in usefulness from a route standpoint, she represents a very modest investment that is relatively inexpensive to maintain and very inexpensive to operate.

It should be noted that this review of WSF vessel condition represents conditions as of the writing of this report. During the course of this study new condition information has been discovered in the Steel Electric class vessels and with the *Hyak* and it can be anticipated that condition assessments will continue to evolve.

Key Recommendations on Vessel Condition. Based on their condition, replacement of the three active Steel Electric class vessels built in the 1920s (operating on the Port Townsend-Keystone and Anacortes inter-island routes) and of the *Rhododendron* built in the 1940s (operating on the Point Defiance-Tahlequah route) should be the top priority in the WSF capital program. An expedited procurement process for the replacement of these four vessels is recommended. WSF's fourth Steel Electric class vessel, now inactive, should be retired from the system.

WSF should review its preservation and maintenance planned out of service times to reduce the number of vessels needed to maintain the existing level of service by reducing the amount of time vessels are out of service. This will require negotiations with the shipyards to speed up work and/or doing more preservation and maintenance work while the vessel is underway.

WSF should enhance its preservation program by improved bilge and void maintenance, instituting a visual inspection/audio gauging steel preservation program for older vessels, considering standardized cabin maintenance materials, and providing preservation funding for inactive vessels or retiring them out of the fleet.

Vessel Replacement

The projected replacement dates of the active vessels should be the driver of the vessel preservation and maintenance program, with the goal to maintain vessels to be fully operational for their expected life spans, while not over-investing in vessels that are scheduled for replacement. A comprehensive replacement plan is key to determining the financing necessary to preserve existing ferry capacity, to avoid service disruptions or diminutions, and to avoid emergency procurement conditions.

Rebuild/replacement assumptions and experience. The expected life of WSF's auto-passenger ferries is 60 years. This is the optimal lifespan in terms of system replacement costs, the reduction in hull integrity, and changes in technology and service needs. For all except the Issaquah class vessels, WSF assumes the vessel is to be rebuilt at the 30-year point. For the Issaquahs, WSF is conducting periodic major maintenance. However, WSF has not been able to adhere to this model in the fleet replacement program for its older vessels. For example, the Steel Electrics were rebuilt when they were already nearing 60 years of age. The Super class *Hyak*, now 40 years old, has not been rebuilt, but its sister *Elwha* was rebuilt six years early.

WSF has also added capacity to five of the six Issaquah class vessels by adding a second car deck. This addition expanded the vehicle capacity on each vessel from 90 to 124. Only the *Sealth* did not undergo the capacity increase.

New vessel plan. The 2007-09 financial plan[1] includes $347.6 million to build four 144-car vessels, to be delivered between 2011 and 2015. The deployment plan for these vessels retires one active Steel Electric, the *Rhododendron*, the *Hyak,* the inactive *Evergreen State*, and an inactive Steel Electric. The plan moves the *Elwha*, due for retirement in 2025-30, to inactive status in the fall, winter, and spring. The new vessels will increase fall, winter, and spring auto capacity by 7 percent (176 cars), and summer capacity by 12 percent (320 cars).

The new vessels do not replace the two Steel Electrics assigned to the Port Townsend-Keystone route.

Replacement needs. Based on WSF's projected vessel retirement dates, WSF must plan for the replacement of 18 of its 21 active vessels between 2008 and 2044. In other words, WSF needs to replace or plan the replacement of 77 percent of its existing auto capacity in the next 36 years. Vessel replacement will be a critical variable in future ferry financing. Currently WSF's process for new vessel planning, design, procurement, and construction takes approximately 10 years.

Vessel, terminal, and shoreside improvements. The Port Townsend-Keystone route shows the importance of route based planning that considers the vessel, terminal, shoreside improvements, and community reaction on both sides of the route. For this route, it was originally assumed that Steel Electric class vessels would be replaced with larger vessels, which would require significant changes to both terminals. But a separate terminal planning process in 2003 to 2006 determined that the community would not accept the impact of a larger terminal, and that moving the Keystone Harbor terminal was not feasible. Thus, a change in plans was needed for the vessels as well. This delay exacerbated the urgent need for replacement vessels.

Key Recommendations on Vessel Replacement. WSF should develop and present to the legislature a consistent vessel rebuild/replacement plan and a vessel deployment plan that integrates terminal, vessel, and shoreside improvement planning, scheduling and budgeting. Beyond the increases in vessel capacity contemplated in the new 144-car vessel deployment plan, additional capacity should relate to the ridership forecast, level of service standard, operational changes, and terminal design standards as required by ESHB 2358. Alternatives to new vessel construction, such as changes in service levels or adding capacity to existing vessels, should be considered before building new vessels to add capacity. WSF should use route based planning including assessing community reactions to vessel capacity changes, to create a route based capital budget to present to the Office of Financial Management and the legislature.

[1] The financial plan adopted to implement the 2007-09 biennial and 2007 supplemental budgets passed by the 2007 legislature.

Capital Financing

2005-07 expenditures. In the 2005-07 biennium, WSF expended $182.9 million in capital funds, of which 41 percent ($75.8 million) was for auto-passenger vessels and 2.6 percent ($4.8 million) was for emergency repairs to these vessels. Of the non-emergency vessel expenditures, 43 percent was for vessel preservation, 32 percent for new vessel acquisition, and 25 percent for systemwide projects. Combined staff and outside design expenses accounted for 18 percent of total vessel capital expenses.

The largest expenditures for existing vessels were for the Super class vessels built in the 1960s (49 percent of all vessel expenditures), Issaquah class vessels built in the 1980s (29 percent), and Jumbo Mark 1 class vessels built in the 1970s (17 percent). Four vessels (the *Elwha, Hyak, Walla Walla,* and *Sealth*) received 70 percent of the capital funding.

WSF spent $18.6 million on vessel-related systemwide projects, such as security infrastructure and planning, communications improvements, and system support. The largest single emergency repair was $2.1 million for the *Elwha*.

In the 2005-07 biennium, WSF also spent $24.3 million on the new 144-car vessel procurement. Expenses for the procurement have totaled $30.2 million since 2003.

WSF spent less on vessel capital in the 2005-07 biennium than anticipated by the legislature in the 2005 and 2006 sessions. The preservation budget was under-spent by 21 percent. Of particular concern is the under-spending for preservation of the Steel Electric class vessels and the *Rhododendron*, since they are the oldest vessels in the fleet, and for preservation of the Issaquah class vessels, since they are to undergo periodic major maintenance rather than 30-year major rebuilds. The systemwide projects were overspent by 17 percent from the level anticipated in the 2006 legislative session. The emergency repair budget, excluding the $300,000 spent on terminals, also was overspent by 20 percent from the amount included in the 2006 legislatively approved project list.

2007-08 biennium and 16-year capital plans. The 2007-23 16-year capital financial plan totals $2.238 billion for WSF, of which 55 percent is for terminals, 43 percent for vessels and 2 percent for emergencies. Of the $968.9 million planned for vessels, 63 percent is for vessel preservation, 32 percent for new vessel acquisition, and 5 percent for systemwide projects.

Vessel preservation projects in the 16-year plan total $48.9 million for the 2007-09 biennium and $608.1 million for 2007-23 period. The 16-year plan reflects a shift in preservation funding to the Jumbo Mark II class vessels built in the 1990s, which will begin to need substantial preservation work.

The 16-year plan includes funding for four new 144-car vessels, which will be deployed to retire three active and two inactive vessels. No funds are included in the 16-year plan to replace five additional vessels due for retirement in the 2008 to 2030 time period, nor for replacement design for four more vessels that are due for retirement starting in 2032.

In the 2007-09 biennium budget, the legislature delayed funding for terminals pending completion of studies required by ESHB 2358. Vessel capital funding of $202.4 million and emergency repair funds of $6.4 million were appropriated. The 2007-09 emergency repair appropriation has been substantially expended during the first three months of the biennium for emergency repairs to the Steel Electric class vessels..

Key Recommendations on Capital Financing. The vessel capital funding provided in the 2007-23 16-year plan is insufficient either to preserve the existing fleet or to replace vessels that are coming due for replacement during the plan period. The consultants recommend that WSF, in implementing ESHB 2358, examine its capital program to separate maintenance activities from capital and to clearly delineate improvement projects now carried in the preservation capital budget. The legislature should consider increased capital funding for vessel preservation, prioritize vessel preservation over improvements, budget for vessel replacement and preservation, and consider shifting funds from terminals to vessels.

Maintenance & Repair Operating Finance

Vessel maintenance and repair is the responsibility of the Director of Vessel Maintenance and Repair reporting to the Executive Director of WSF. There are four sections beneath the Director: Digital Systems, Vessel Preservation, Vessel Maintenance, and Eagle Harbor. The vessel preservation staff is responsible for all work done in commercial shipyards; the maintenance staff oversees purchasing, regular maintenance work, and the engine room crews; and the Senior Port Engineer for Eagle Harbor oversees five supervisory and administrative staff and 100+ trade staff.

Vessel maintenance and repair budget structure. The vessel maintenance and repair budget is found in three of WSF's operating budget (Program X) subprograms: X1 Vessel Operations, X4 Vessel Maintenance, and X7 Maintenance Management and Support. In the 2005-2007 biennium, vessel maintenance and repair expenses totaled $105.4 million, with labor being the largest expense at $77.8 million.

Labor expenses. WSF has little opportunity to control ship crew labor costs, with minimum requirements set by the USCG and 92 percent of WSF employees represented by labor unions. Labor agreements include requirements for overtime pay and minimum staffing requirements which directly affect repair and maintenance labor costs. Seventeen percent (17%) of labor costs are attributable to overtime, penalty pay, and travel time pay.

Repairs. Forty-four percent (44%) of the $19.8 million in repair costs in the 2005-07 biennium were for drydock related charges[2]. These repairs drydocking costs are in addition to expenditures on drydocking in the capital budget. The USCG requires that every vessel be drydocked twice every five years with no more than three years in

[2] Drydocking is when a vessel is completely removed from the water to allow inspection of sections of the vessel normally underwater.

between. WSF states that they limit the scope of work during these credit drydockings to those items that are required by regulation or can only be done while the vessel is out of water.

2007-09 Biennium. The vessel maintenance and repair budget for the 2007-09 biennium is $111.6 million, which is $6.2 million or 6% higher than actual expenditures in the 2005-07 biennium. The increased budget is primarily due to recent labor agreement settlements.

Eagle Harbor repair and maintenance expense 2005-07. In the 2005-07 biennium, Eagle Harbor total auto-passenger vessel costs were $14.1 million, of which $13.5 million was for maintenance and $0.6 million was for capital expenses.

Key Recommendations on Maintenance and Repair Operating Finance. The consultants found that the Vessel Maintenance and Preservation Division has limited management staffing for both preservation and maintenance. Additional resources may be necessary to implement the recommendations in this report, and should come from internal realignments within WSF if possible. The consultants also recommend WSF consider ways to reduce the amount of time spent in credit (required by the United States Coast Guard) and maintenance/preservation (done for vessel repairs) drydockings as a cost-savings measure and review the 2007-09 repair budget to ensure that it contains adequate repair and maintenance funding.

Table 1. Consultant Recommendations

Area	Recommendation
Vessel Condition	1. For the Steel Electrics and the *Rhododendron:* a. Replace the active vessels expeditiously. b. Expedite Steel Electric and Rhododendron replacement procurement process.
	2. Consider rebuild of the *Hyak.*
	3. Reduce drydock and other planned out of service times. a. Review shipyard contracts. b. Conduct preservation work while vessels are underway.
	4. Maintenance and preservation: a. Institute a bilge and void maintenance program. b. Institute a visual inspection/audio gauging steel preservation program for older vessels c. Institute an integrated coating program. d. Consider standardized cabin maintenance materials. e. Provide preservation funding for inactive vessels or retire them out of the fleet.
Vessel Replacement	1. Develop a consistent and legislatively reviewed vessel rebuild/replacement plan.
	2. Develop a legislatively reviewed vessel deployment plan that maximizes the utilization of existing vessels.
	3. Relate increases in vessel capacity to ridership forecast, level of service standard, operational changes, and terminal design standards.
	4. Consider alternatives to new vessel construction to increase capacity.
	5. Prioritize and commit vessel replacement funding.
	6. Use route-based planning.
	7. Gauge community reaction to vessel capacity changes.
	8. Present route-based capital budgets.
Capital Financing	1. Implement EHSB 2358: a. Definition of capital. b. Improvement vs. preservation. c. Systemwide and administrative capital program cost allocation.

Area	Recommendation
	d. LCCM and asset management program.
	2. Vessel preservation funding: a. Improve preservation program management. b. Tie vessel preservation funding to the vessel replacement plan. c. Prioritize vessel preservation over vessel improvement funding. d. Consider increasing preservation funding. e. Do not reduce preservation funding to pay for new vessels.
	3. The vessel emergency repair budget should not be used for planned maintenance and inspections of inactive vessels.
	4. Increase vessel replacement funding.
	5. Prioritize vessel funding over terminal improvement funding.
Maintenance and Repair Operating Finance	1. Consider internal realignment to increase maintenance and preservation division management.
	2. Reduce planned out of service credit drydocking time.
	3. Consider implementation of State Auditor's recommendations on Eagle Harbor double shifts.
	4. Review 2007-09 biennium repair budget.

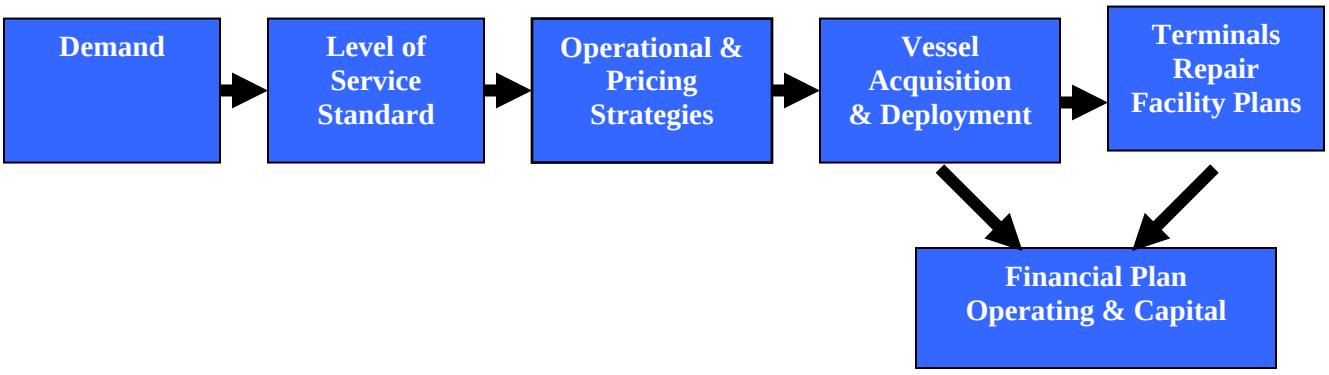
Section I.
Introduction

This review of Washington State Ferries' (WSF) vessel preservation and replacement program is being conducted for the Joint Transportation Committee (JTC) pursuant to budget provisios adopted by the 2007 legislature. The budget provisios direct the JTC to review vessel preservation costs and to make recommendations regarding the most efficient timing and sizing of future vessel acquisitions beyond the currently authorized four new 144-car vessels.

A. ESHB 2358 – The Ferry Bill

In 2006 the JTC conducted a ferry financing study. The study recommended that the legislature use a ferry financing decision model as a framework for ferry decisions. Under the model, ridership projections, level of service standards, and pricing and operational strategies are the basis for long-range vessel and terminal capital and operating financial decisions. The model is interactive, with decisions made at any point affecting other areas.

Figure 1. Ferry Finance Decision Model



In the 2007 session, the legislature passed ESHB 2358 and budget provisios that require coordinated actions by WSF, the Washington State Transportation Commission (WSTC), the Office of Financial Management (OFM), the Joint Legislative Audit and Review Committee (JLARC), and the JTC. The legislature has directed WSF to adopt adaptive management practices in its operating and capital programs in order to keep costs as low as possible while continuously improving the quality and timeliness of service.

WSF, pursuant to direction provided in ESHB 2358, is reviewing demand, vehicle level-of-service standards, and operating and pricing strategies. This study of vessel preservation and replacement is being conducted before these reviews are complete. The consultants have based their recommendations on existing ferry operations and ridership. Additional vessel sizing and acquisition reviews will be conducted in 2008 with the revised demand forecast, vehicle level-of-service standard, and operating and pricing strategies.

B. Basis of Review

The review is based on the 16-year capital program from the 2007 legislative session and actual expenditures in the 2005-07 biennium.

The consultants conducted a visual inspection and tour of auto-passenger ferries; interviewed WSF staff from the Finance and Administration, Vessel Maintenance and Preservation, Vessel Engineering, and Planning sections; and reviewed and assessed the vessel life cycle cost model (LCCM), vessel engineering reports, fleet assignment schedule, and new 144-car vessel deployment plan.

WSF owns and operates 28 vessels, of which four are passenger-only ferries (POF). The Washington State Legislature has directed WSF to discontinue passenger-only service, with the current POF service limited to the Vashon-Seattle route until King County takes over that route. This review is focused on WSF's 24 auto-passenger ferries.

C. Other JTC Ferry Studies

In addition to this review, the JTC is directed by 2007-09 budget provisos to study:

- Administrative operating costs
- Nonlabor and nonfuel operating costs
- Capital systemwide and administrative costs
- Eagle Harbor maintenance program and costs
- Long-term financing

This review of vessel preservation and replacement will include reviews of vessel capital systemwide projects, and Eagle Harbor and other vessel operating maintenance costs consistent with legislative direction.

Section II.
Auto-Passenger Vessels

This section provides a profile of WSF's 24 auto-passenger ferries, including their classes, assignments, ages, and auto capacity.

A. Vessel Classes

WSF's 24 auto-passenger vessels service WSF's nine routes in Puget Sound and the San Juan Islands. As shown in Table 2, 22 of the auto-passenger vessels fall into six distinct classes, reflecting when they were built. Two miscellaneous vessels were individually acquired.

WSF has four (4) Steel Electric class vessels built in 1927; three (3) Evergreen State class vessels built in the 1954-59 time period; four (4) Super class vessels built in 1967; two (2) Jumbo Mark I vessels built in 1972; six (6) Issaquah class vessels built in the 1979-82 time period; and three (3) Jumbo Mark II vessels built in 1997-98. The two (2) miscellaneous class vessels are the *Hiyu*, acquired in 1967, and the *Rhododendron*, built in 1947.

Table 2.
Auto-Passenger Vessels

Class	Vessel *Replace in new vessel program	Vehicle Capacity	Year Built / Rebuilt	Current Route and Season	Retirement Range**
1920s					
Steel Electric	*Illahee**	59	1927 / 1986	Anacortes-all	2010-15
	Klickitat	64	1927 / 1981	Keystone-all	2008-13
	*Nisqually**	59	1927 / 1987	(de-crewed/standby-all)	2008-13
	Quinault	59	1927 / 1985	(maint-FWS) Keystone-Su	2010-15
1940s					
Misc.	*Rhododendron**	48	1947 / 1991	Pt Defiance/Tahlequah-all	2011
1950s					
Evergreen State	*Evergreen State**	87	1954 / 1988	(de-crewed/standby-all)	2010-15
	Klahowya	87	1958 / 1995	Fauntleroy/Vash/South-all	2023-28
	Tillikum	87	1959 / 1994	Fauntleroy/Vash/South-all	2022-27
1960s					
Super	*Elwha*	144	1967 / 1991	Anacortes-all	2025-30
	*Hyak**	144	1967 / --	(maint-all)	2010-15
	Kaleetan	144	1967 / 1999	Seattle/Bremerton-FWS, Anacortes-Summer	2027-32
	Yakima	144	1967 / 2000	Anacortes-all	2028-33
Misc.	*Hiyu*	34	1967 / --	(de-crewed/standby-all)	2008-13

Class	Vessel *Replace in new vessel program	Vehicle Capacity	Year Built / Rebuilt	Current Route and Season	Retirement Range**
1970s					
Jumbo Mark I	*Spokane*	188	1972 / 2004	Edmonds/Kingston-all	2032-37
	Walla Walla	188	1973 / 2003	(maint-FWS) Seattle/Bremerton-Su	2031-36
1980s					
Issaquah	*Issaquah*	124	1979 / ongoing	Fauntleroy/Vash/South-all	2037-42
	Kitsap	124	1980 / ongoing	Seattle/Bremerton-all	2038-43
	Kittitas	124	1980 / ongoing	Mukilteo-all	2038-43
	Cathlamet	124	1981 / ongoing	Mukilteo-all	2039-44
	Chelan	124	1981 / ongoing	(maint-FWS) Anacortes-Su	2039-44
	Sealth	90	1982 / ongoing	Anacortes-FWS (maint.-Su)	2040-45
1990s					
Jumbo Mark II	*Tacoma*	202	1997 / 2027	Seattle/Bainbridge-all	2055-60
	Puyallup	202	1998 / 2028	Edmonds/Kingston-all	2056-61
	Wenatchee	202	1998 / 2028	Seattle/Bainbridge-all	2056-61

* WSF New Vessel Deployment Plan – Sept. 21, 2007. Replacements are accomplished by re-deployment throughout the WSF system.
** Revised by WSF October 2007

Key:
FWS = fall, winter, spring Su = summer All = all seasons

B. Vessel Assignments: Active and Inactive

As shown in Table 1, WSF actively uses 21 vessels either assigning them to a specific route year-round (16 vessels) or using them for maintenance relief at least part of the year. A maintenance vessel has an assigned crew and is used to relieve other vessels of its same class or relative size for maintenance and preservation. Twenty (20) vessels are assigned to routes in the summer peak season, with one vessel (*Hyak*) used as maintenance relief all year.

Three vessels are stand-by vessels, without specific routes or assigned crew, and are available for unanticipated service needs. (WSF New Vessel Deployment, Sept. 21, 2007). No capital funding for preservation of these inactive vessels is provided in WSF's capital program.

These inactive vessels have been pressed into service during periods of unplanned vessel breakdowns or other issues. For the one year period March 2006 through February 2007,

for example, the *Evergreen State* was used a total of 49 days or 13 percent of the time. Since the hull issues on the Steel Electric class began to surface in March 2007 (see discussion below), the *Evergreen State* has been used 66 percent of the time and even the *Nisqually* and *Hiyu* have been utilized.

C. Vessel Ages

As shown in Table 2, five (5) of WSF's auto-passenger ferries are between 60 and 80 years old, eight (8) are between 40 and 53 years old, eight (8) are 25 to 35 years old, and three (3) are nine to 10 years old. Three of the oldest vessels are assigned to the Keystone-Port Townsend and Point Defiance-Tahlequah routes which service 6 percent of WSF ridership. One of the oldest vessels is assigned to the inter-island service on the Anacortes based routes. Two of the intermediate age vessels, those between 40 and 53 years old, are assigned to the Fauntleroy route. Seventy-two percent of riders are on routes that are totally served by vessels 40 years old or newer.

The inactive vessels include one that is 80 years old (Steel Electric *Nisqually*), one that is 53 years old (*Evergreen State*) and one that is 40 years old (*Hiyu*).

As is discussed in more detail in the next section, WSF plans for a 60 year service life for its vessels.

Table 3.
Vessel Assignment and Age

Route	# of Vessels	Vessel Ages Years 2007	% of ridership 2006
Keystone	2	80	3%
Point Defiance	1	60	3%
Fauntleroy	3	49, 48, 28	13%
Anacortes	6	80, 49 (3), 26, 25	8%
Edmonds	2	35, 8	18%
Bremerton	3	40, 35, 8	10%
Mukilteo	2	27, 26	17%
Bainbridge	2	10, 9	27%
Active Vessels	*21*		
Inactive Vessels	*3*	80, 53, 40	

D. Vessel Capacity: Auto

WSF's *Draft Long-range Strategic Plan 2005-30* found that walk-on passenger service demand could be met through 2030, with the exception of the most congested sailing on the Bainbridge Island route. The constraint on the system is capacity for autos, which in WSF's past long-range plans has driven proposed system increases. (See *Washington State Ferries Financing Study Final Report*, January 2007, for further discussion.)

The total auto capacity for the 21 vessels in active service is 2,672 cars, with three vessels carrying between 48 and 64 cars, three between 87 and 90, eleven between 124 and 188, and three carrying 202 cars. The three inactive vessels have a total capacity for 180 cars.

Table 4.
Auto Capacity

Vessel Class	Active Vessels: 21	Auto Capacity	Inactive Vessels: 3	Auto Capacity
Steel Electrics	Klickitat	64	Nisqually	59
	Illahee	59		
	Quinault	59		
Misc	Rhod.	48	Hiyu	34
Evergreen State	Klahowya	87	Evergreen State	87
	Tillikum	87		
Super	Elwha	144		
	Hyak	144		
	Kaleetan	144		
	Yakima	144		
Jumbo Mark I	Spokane	188		
	Walla Walla	188		
Issaquah	Issaquah	124		
	Kitsap	124		
	Kittitas	124		
	Cathlamet	124		
	Chelan	124		
	Sealth	90		
Jumbo Mark II	Tacoma	202		
	Puyallup	202		
	Wenatchee	202		
Total		2,672		180

Section III.
Vessel Condition

This section reviews the condition of WSF's vessels and makes recommendations on the replacement of WSF's oldest vessels, on a cost-benefit analysis of rebuild investments in the Super class *Hyak*, and on vessel bilge maintenance.

Importantly, this section concludes that, based on their condition, replacement of the three active Steel Electric class vessels built in the 1920s (operating on the Port Townsend-Keystone and Anacortes inter-island routes and currently out of service for more steel inspection) and of the *Rhododendron* built in the 1940s (operating on the Point Defiance-Tahlequah route) should be the top priority in the WSF capital program. An expedited procurement process for the replacement of these four vessels is recommended. The inactive Steel Electric class vessel, the fourth Steel Electric owned by WSF, should be retired from the system.

This section also concludes that WSF should review its planned out of service times for preservation and maintenance through negotiations with the shipyards and potentially doing more work while the vessel is underway. The goal should be to reduce the number of vessels needed to maintain the existing level of service by reducing the amount of time the vessels are out of service.

A. Vessel Life Cycle Cost Model Condition Rating

1. Vital System Rating

WSF has used a life cycle concept to identify investments needed to ensure its terminals and vessels are preserved. The terminal life-cycle cost model (LCCM) was reviewed in the *Washington State Ferries Financing Study Final Report*, January 2007, Appendix 3.

WSF identifies a life cycle rating for vital and non-vital systems in the LCCM to track performance and vessel condition. The life-cycle rating is the percentage of a vessel's systems that are operating within their life cycle at a particular point in time. This percentage is weighted by the cost of replacement so that the percentage reflects the overall cost of replacing the system when due. WSF tracks performance against goals recommended by the 2001 Joint Legislative Task Force on Ferries, which are to have by 2015:

- 90 to 100 percent of vital systems operating within their life cycle; and
- 60 to 80 percent of non-vital systems operating within their life cycle.

The existing LCCM, which WSF is revising to conform to the requirements of ESHB 2358, provides a condition rating for vessels. The table below shows the percentage of vital systems operating within their life cycle for each active vessel. The gray area shows where the vessel meets the life cycle goal of having 90 to 100 percent of vital systems operating within their life cycle. The olive color indicates that 80 to 90 percent of vital systems are operating within their life cycle, or within 10 percent of the goal.

As will be noted, the active vessels have a high percentage of vital systems operating within or near the performance goal. The exception is the *Hyak*, which, as discussed below, has not been totally rebuilt and, as a consequence, has the lowest percentage of systems operating within their life cycle of any active vessel. (See the next section for a discussion of investments made in the *Hyak* in the 2005-07 biennium and in the 2007-23 16-year plan.)

Table 5.
Active Vessel Condition: Percentage Vital Systems Operating within Life Cycle

		Start	05-07	07-09	09-11	11-13	13-15	15-17	17-19	19-21	21-23
Steel Electric: 1920s											
Illahee	Vital	91%	89%	88%	LCCM assumed retirement in 2009-11						
Klickitat	Vital	92%	85%	83%	LCCM assumed retirement in 2009-11						
Quinault	Vital	90%	84%	75%	LCCM assumed retirement in 2009-11						
Miscellaneous, 1940s											
Rhod.	Vital	91%	97%	97%	74%	LCCM assumed retirement in 2011-13					
Evergreen State, 1950s											
Klahowya	Vital	92%	92%	92%	92%	92%	85%	85%	85%	85%	98%
Tillikum	Vital	98%	97%	97%	97%	96%	87%	87%	87%	86%	92%
Super, 1960s											
Hyak	Vital	28%	32%	22%	22%	9%	8%	7%	7%	7%	19%
Kaleetan	Vital	98%	100%	93%	93%	93%	100%	100%	100%	100%	100%
Yakima	Vital	85%	98%	98%	91%	98%	100%	100%	100%	99%	100%
Elwha	Vital	90%	100%	96%	96%	98%	100%	100%	100%	100%	99%
Jumbo Mark I, 1970s											
Spokane	Vital	100%	99%	99%	99%	93%	95%	94%	94%	94%	95%
Walla Walla	Vital	60%	76%	75%	76%	76%	77%	78%	78%	78%	100%
Issaquah, 1980s											
Cathlamet	Vital	90%	82%	82%	82%	68%	93%	92%	92%	93%	100%
Chelan	Vital	78%	71%	65%	52%	51%	65%	66%	66%	68%	98%
Issaquah	Vital	90%	82%	82%	82%	74%	93%	93%	93%	96%	85%
Kitsap	Vital	67%	82%	81%	89%	81%	100%	100%	100%	100%	96%
Kittitas	Vital	99%	93%	93%	93%	92%	100%	100%	100%	100%	98%

		Start	05-07	07-09	09-11	11-13	13-15	15-17	17-19	19-21	21-23
Sealth	Vital	95%	91%	91%	91%	91%	99%	99%	99%	100%	88%
Jumbo Mark II, 1990s											
Puyallup	Vital	100%	100%	94%	99%	99%	99%	99%	99%	99%	98%
Tacoma	Vital	100%	100%	99%	99%	97%	100%	100%	100%	100%	100%
Wenatchee	Vital	100%	100%	100%	100%	99%	99%	99%	100%	100%	93%

Source: WSF Vessel LCCM 2007 LEAP (Proposed) V2007-5 Updated January 2007
Key: Olive = 80 to 90% of vital systems operating within their life cycle; Gray = 90 to 100%

2. Steel Condition

It is important to note that the LCCM does not measure the condition of the hull steel nor is hull steel replacement a component of the LCCM.

The steel maintenance program undertaken by WSF includes audio gauging, which measures the thickness of the steel to determine the degree of wasting. The status of WSF's hull steel gauging is show in Appendix A.

The American Bureau of Shipping (ABS), which is a major agency that rates commercial ships for insurance purposes, typically requires periodic audio gauging of the hulls of ships once they reach 25 years old. Audio gauging approximately every 24-36 months, combined with regular ABS inspections, provides owners and insurers with vital condition information. These inspections are in addition to the regular Coast Guard inspections.

WSF follows Notes on Steel Maintenance that are similar to the ABS requirements. Vessels of the WSF fleet are gauged 10 years after a major renovation or after their construction date. After 10 years, vessels are gauged at 5 year intervals. WSF limits its gauging. "Deep pitting over an area, holes, fractures, excessively thin edges on structural shapes, bands or belts of corrosion across bottom plating which may indicate heavy working, are all justifiable basis for requiring gauging in the effected area. *However, (italics original),* care must be exercised not to extend the gauging so as to have it become a fishing expedition." (WSF provided *Notes on Steel Maintenance.*)

WSF needs an even more detailed process for steel inspection than commercial carriers which expect their vessels to operate for 30 years. WSF's vessels are intended to operate for 60 years and will require a more intensive steel maintenance program.

B. Steel Electric Class and Rhododendron – Built 1920s and 1940s

The table above shows that the three active Steel Electric class vessels have 90 percent or more of their vital systems operating within their life cycle and the *Rhododendron* has 91 percent.

The Steel Electrics have experienced steel deterioration problems in the hull that are not reflected in the percentage of vital systems operating within their life cycle. Hull

problems were found in 2007 and have led to emergency repairs to the Steel Electric class vessels totaling $2.6 million during the first quarter of the 2007-09 biennium (July 1 to Sept. 30, 2007).

As the Steel Electric class vessels do not meet current USCG damage stability requirements (one compartment vs. two compartment flooding requirements), any conditions affecting hull integrity are of more concern to the USCG than they would be for vessels meeting the standard. The USCG must issue a Certification of Inspection (COI) for vessels to be in service. As a COI condition, the USCG is requiring that all concrete be removed from all Steel Electric class vessels to allow inspection of the hull.

In July 2007, WSF hired a third-party inspection company to conduct comprehensive hull surveys of all four Steel Electric vessels. The surveys were completed at the end of September 2007 and gauging reports prepared. A total of 160 fractures were found in the four vessels which are being repaired and or evaluated by WSF. Only one fracture was a class 1 fracture (in the *Illahee*) that might threaten the watertight integrity of the vessel. [3]

A gauging report represents many pinpoint readings in vast areas of plating, and is only indicative of overall condition. A thorough gauging survey does not mean that further holes or cracking will not be found or that further damage to structure will not occur.

All four Steel Electric vessels were pulled from service in November 2007 to undergo further testing of the steel in the hulls. Their scheduled return to service is not known at the time of this report.

1. Quinault

The *Quinault* is normally assigned in the summer to the Keystone-Port Townsend route. In May, 2007, while in service on the Anacortes based routes, the engineering crew of the *Quinault* found a small hole in the hull near the bow of the vessel, above the waterline under the car deck overhang. WSF's Eagle Harbor Repair and Maintenance staff immediately made a temporary repair, and the USCG allowed the vessel to operate until the end of June, at which time a permanent repair was required. In late June, as a result of the hole found on the *Illahee* shortly after her return to service following drydocking in June, 2007, the crew on the *Quinault* inspected her hull in the same location, and found a hole there. The vessel was then immediately pulled from service. In late July the vessel went to Todd Shipyard for drydocking to have the concrete removed from her hull per a requirement from the USCG issued to all vessels of her class on June 26, 2007. The *Illahee* was also being drydocked at the same time at the shipyard, as she had experienced

[3] There are three classes of fracture: Class 1 –Visible, through-thickness fractures of any length in the oil-tight envelope of the outer shell where threat of pollution is a factor or a fracture or buckle which has weakened a main strength member to the extent that the safety of the vessel to operate within design parameters is compromised. Class 2 – A fracture or buckle within a main strength member which does not compromise the safety of the vessel to operate within design parameters and does not create a threat of pollution by location or containment. Class 3 – Any fracture or buckle which does not meet the definition of Class 1 or 2, or a Class 2 fracture that is determined not to be detrimental to the strength or serviceability of the effected main hull structural member. (WSF Steel Electrics – Hull Summary and Condition Summary, Oct. 29, 2007)

a cracked stern tube following the removal of concrete from her hull in July, 2007 at Dakota Creek Shipyard in Anacortes.

Upon opening the hull of the *Quinault for* concrete removal, her original cast iron stern tubes were also found to be deficient, and the old tubes were removed. Both the *Illahee* and *Quinault* came off the drydock they shared on September 14th. The *Illahee* returned to service after replacement of both of her stern tubes, and the *Quinault* to Eagle Harbor, as her repair work had not yet been completed and Todd Shipyard had other commitments for their drydock. On October 15th, the *Quinault* returned to the drydock at Todd shipyard for completion of her repairs, which are ongoing at the time of this report.

2. Klickitat

The *Klickitat*, which is assigned year-round to the Port Townsend-Keystone route, is similar to other vessels in the Steel Electric class in capacity and condition, with one important difference. The other three vessels of the Steel Electric class have had their engine controls (a DC diesel electric plant) upgraded to bridge control. Bridge control allows control of the speed and direction of the electric propulsion motors from the wheelhouse without the need for an engineer in the engine room to control the motors. Bridge control, however, does not respond as quickly to movement of the bridge control levers, as there are built-in protection and other features in the control system that make the response take a longer time. Thus, the *Klickitat* is preferred for the Port Townsend-Keystone route as stopping response time (and thus the distance in which the vessel stops) is critical. When the consultants rode the vessel, the timed stopping from 10 knots was 48 seconds, which is a very short stopping period from that speed.

Unlike any other terminal, the vessel approach to Keystone requires almost full speed as the vessel enters the harbor, to mitigate the effects of swirling currents just at the entry point. With only 3-4 vessel lengths between the entry point and the dock, the vessel must go from full ahead speed and direction to full astern speed and direction in a very short time. While the *Klickitat* would thus seem the prime choice for this route, from a safety standpoint the operation depends entirely on the vigilance and physical condition of the single engineer at the controls in the engine room. If the engineer were to be disabled for any reason, the vessel would impact the pier at Keystone at full speed; there is no way the bridge operator could stop it and there is a risk that the second staff member in the engine room could not reach the controls within the one available minute. It should also be noted that even if it were apparent to the officer on the bridge that something had gone wrong in the engine room, there would not be enough time, room, or distance to avoid hitting the pier. The consultants estimate the weight of the *Klickitat* at approximately 2,800 tons, or about 6 million pounds. The damage to pier, people, and vehicles would be considerable in the event of a collision with the pier. Although a potential risk, it should be noted that no such incidents have occurred.

3. Illahee

The *Illahee*, which is assigned year-round to the Anacortes based inter-island route, was upgraded in 1986. The upgrade of machinery controls included reconfiguring the

propulsion motor and fitting new generators. The revised controls on the *Illahee* have had a number of ongoing problems.

The concrete removal and steel work called for by the USCG for the Steel Electrics (see above) was done in 2007 for the *Illahee*.

4. Nisqually

The *Nisqually*, which is an unassigned, de-crewed vessel, is assessed by WSF to be in the worst overall condition of the Steel Electric class vessels.

The *Nisqually* was last dry docked in December of 2006 and her Certificate of Inspection expires May 8, 2008. The dry docking period is a USCG requirement and that would likely be the latest date the USCG would allow for the cement removal inspection.

5. Rhododendron

The *Rhododendron*, which is assigned to the Pt. Defiance-Tahlequah route, is presently 60 years old and was upgraded in 1991. Because the original ship was riveted and replacement plating has been welded, it was relatively easy for the consultants to see repairs to the car deck and shell plating. In a similar fashion to the Steel Electric class vessels, the *Rhododendron* has concrete installed in the shaft alley and bottom spaces.

The extent of concrete installation in the Rhododendron is similar to that in the Steel Electric class vessels. The cost to repair these areas cannot be roughly estimated until the concrete is removed. At that point, most of the offending plating will have been removed, so there will really be no choice but to repair.

In addition, the fender that surrounds the *Rhododendron* has started leaking into the vessel and the leaks have been found to contain salt water. This leakage could indicate considerable corrosion at the junction of the side shell to the car deck. Repairs to this area were accomplished in August and September 2007. Repairs to the opposite side have been deferred, with approval of USCG, until the next opportunity for repair.

C. Evergreen State Class Vessels – Built 1950s

The three vessels in this class include an inactive vessel, the *Evergreen State*, and two active vessels assigned to the Fauntleroy-Southworth-Vashon route.

1. Evergreen State

The *Evergreen State* is a de-crewed, inactive vessel. No funds are provided in the WSF capital program for her preservation. The LCCM shows that in 2007 this vessel has 94 percent of its vital systems operating within their life cycle and 35 percent of non-vital systems.

This vessel was not upgraded with new EMD (Electro Motive Division) machinery and controls in 1995 with the other two vessels in this class. The *Evergreen State* has 1988 Stork main engines (which are not original, but are a bit older than the EMD replacements), and is the only vessel in the fleet left with an old control system for which

there are very few parts left for repair. While the ship does operate, it does so at the discretion of USCG with regard to reliability of the control system. Failure of the system could result in docking accidents or loss of power in transit. For extended continuous service, the vessel should be refitted with a new control system. Such refitting, however, would best be done with replacement of the main engines and the original EMD engines bought for the *Evergreen State* replacement (and stored now for over 15 years). These engines now no longer meet Environmental Protection Agency (EPA) standards and may not be able to be installed. The propulsion motors and gears are the original equipment 1954; the silicon rectifiers were installed in 1988 and some generator improvements have been made. The result is that a major machinery improvement would have to be made to bring everything up to a compatible system.

It is estimated by the consultants that $20-$25 million would be required for machinery, steel, and other improvements to bring this vessel into roughly the same condition as the other ships in this class. At 53 years of age and a 60-year planned life for WSF vessels, the expenditure of such an amount seems unwarranted.

2. Klahowya and Tillikum

Both of these Evergreen State class vessels are assigned to the Fauntleroy-Southworth-Vashon triangle route. Both vessels are in good shape and have, in the view of the consultants, been well maintained by WSF.

The consultants noted that the *Klahowya* bilges under the new floor plates are quite dirty, oily and, in some areas, corroded.

D. Super Class Vessels – Built 1960s

There are four Super class vessels, one of which, the *Hyak*, is used year-round for maintenance relief. The other three vessels are assigned to the Anacortes based routes, with one assigned to the Seattle-Bremerton route in the fall, winter, and spring seasons.

1. Hyak

The *Hyak* was not rebuilt when the other Super class vessels were re-built in the 1991-2001 time period. As a consequence, she has the lowest percentage of vital systems operating with their life cycle of any active vessel.

The *Hyak* has the same main engines as her sister ships. Her engine control system, switchboards, main propulsion motors, and caterpillar generators were not upgraded as were the other vessels in this class. Steel repairs have not been made in as comprehensive a method as the other vessels in this class, and the passenger spaces are not quite to the same standard as the sister ships. WSF announced on November 30, 2007 that the *Hyak's* drydock time was extended to replace additional steel that had corroded on the vessel's hull.

As will be reviewed in the next section, in the 2005-07 biennium, WSF spent $6.5 million on the *Hyak*, including the addition of an elevator, structural preservation to the hull and interior, and the installation of four refurbished engines. WSF also made security and

communications improvements to the vessel. The 2007-23 16-year plan includes $12.5 million for further preservation work on the *Hyak*.

The consultants estimate that it will cost $15 million to completely bring the *Hyak* to a standard consistent with the other ships in this class. For a 40-year-old vessel, this may be a cost-effective investment.

2. Elwha, Kaleetan, Yakima

The *Elwha, Kaleetan,* and *Yakima* all appear to be well maintained by WSF and are in good condition given their age. This assessment is supported by the LCCM which shows their vital systems operating within the 90 percent of life cycle goal through 2021-2023.

The consultants noted during their tour that the *Kaleetan, Yakima and Elwha* all look excellent in the passenger and engine room spaces. The engine room is partially cosmetic, with visible spaces freshly painted. New floor plates of aluminum have been installed, but the bilges under the new floor plates in the *Kaleetan* are quite dirty, oily and, in some areas, corroded.

E. Jumbo Mark I Class Vessels – Built 1970s

The *Spokane* is assigned to the Edmonds-Kingston route. The *Walla-Walla* is assigned to the Seattle-Bremerton route in the summer and is a maintenance relief vessel in the fall, winter and spring. Both vessels are in good condition and have been well maintained by WSF. The LCCM shows that the *Walla-Walla* has between 60 and 78 percent of her vital systems operating within their life cycle, but that she is due for major work in 2021-23 that will elevate the status of her vital systems to 100 percent operating within their life cycle.

Both vessels were upgraded in 2004-2005 with new main engines, generators, D-C propulsion motors, control systems and switchboards. While the machinery rooms have almost new machinery, similar to the other older vessels, the bilges are showing signs of corrosion in the margin plates. The voids are starting to loose their original coatings. There are also some internal corrosion problems with curbing outboard on the main deck.

F. Issaquah Class Vessels – Built 1980s

Two of the six Issaquah class vessels are assigned to the Mukilteo-Clinton route, one to the Seattle-Bremerton route, one to the Fauntleroy-Vashon-Southworth route and two to the Anacortes routes. The LCCM shows that these ships are operating at or near the goal of having 90 to 100 percent of vital systems operating within their life cycle, with the exception of the *Chelan,* which will receive a major overhaul in 2021-23. The *Chelan* received SOLAS (Security of Land and Seas – a federal requirement for vessels operating in international waters), security, galley and interior upgrades in the 2005 fiscal year.

The re-build dates for these vessels were primarily for the addition of a second car deck, with the exception of the *Sealth,* which did not receive a second car deck. The re-build did not include the normal system replacements since WSF is planning on periodic major maintenance of these vessels rather than the 30-year re-build.

The *Kittitas and Kitsap* were both toured by the consultants and appear to be in good condition and well maintained by WSF, with the exception that additional bilge maintenance should be provided.

G. Jumbo Mark II Class Vessels – Built 1990s

The Jumbo Mark II class vessels are the newest in the fleet, having been delivered to WSF in 1997 and 1998. The vessels are assigned to the Seattle-Bainbridge and Seattle-Edmonds routes and are in excellent condition. WSF plans a major rebuild in the 2028 time period, but will re-assess because they also plan to conduct periodic major maintenance as is being done with the Issaquah class vessels.

H. Hiyu

The *Hiyu*, which is in inactive status, is physically the smallest vessel in the WSF fleet with a length of 162 feet and a car capacity of 34. The passenger capacity of 200 and speed of 10 knots make her a substitute for small, well protected routes such as the Point Defiance-Tahlequah route. While seemingly useful in a very limited sense from a route standpoint, she represents a very modest investment that is relatively inexpensive to maintain and very inexpensive to operate as she has a small crew. Despite her 40-year age, the vessel is in remarkable condition, probably as a result of relatively low operating hours. Another excellent factor from a hull degradation standpoint is that her engines are keel cooled so no salt water enters the vessel for cooling. While the consultants found the bilges were dry during their tour, they still could use some cleaning and re-coating to preserve the vessel's excellent steel condition.

The *Hiyu* has Caterpillar engines that still remain an active model in oil patch and other industries, so the engines are supportable as far as spares. The control system has some updates and her engines are bridge controlled. Overall this vessel seems like a good investment to retain, even though its use is limited.

The USCG requires the vessel be operated on a small sea trial each year. This requirement ensures the vessel is looked at yearly by WSF and the USCG and is ready to run when needed. The sea trial and the *Hiyu's* very simple machinery plant in which little can go wrong provide a better state of readiness and thus less potential cost to return to service than might be the case with larger, more complicated vessels.

There are no preservation funds allocated for this vessel. It appears from the consultant's tour that the existing internal coating (i.e. painting) is beginning to fail.

I. Out of Service Periods

WSF drydocks it vessels and/or takes their vessels out of service dockside to perform maintenance and capital preservation work on them either in a commercial shipyard or at Eagle Harbor. WSF fleet planning assumes that each vessel will be out of service on average of six to eight weeks a year, with the length of time for each vessel varying with the work to be done. The table below shows the planned out of service dates for the 2008 fiscal year (July 1, 2007 to June 30, 2008) with an average vessel out of service period of seven weeks or 13 percent of the year.

As will be noted, based on planned preservation work and the point the vessel is in the preservation cycle (i.e. if the vessel due for a major 10 year system renewal it will out longer than in periods where such a major renewal is not required), vessels will out of service from 4 percent to 38 percent of the year.

Major work on the Jumbo Mark II class vessels, including repainting, accounts for the large percentage of out of service time in the 2008 fiscal year.

(Note: this out of service schedule does not include emergency repairs to the Steel Electric class vessels, but rather planned maintenance only.)

Table 6.
Planned Out of Service Periods 2008 Fiscal Year (weeks)

	Commercial Yard	Eagle Harbor	Total	% of Year
*Steel Electric Class 1920s**				
Illahee	0	3	3	6%
Klickitat	0	3	3	6%
Quinault	0	3	3	6%
Misc. 1940s				
Rhododendron	2	2	4	8%
Evergreen State Class 1950s				
Klahowya	3	3	6	12%
Tillikum	6	2	8	15%
Super Class 1960s				
Elwha	13	2	15	29%
Hyak	10	1	11	21%
Kaleetan	0	4	4	8%
Yakima	0	2	2	4%
Jumbo Mark I Class 1970s				
Spokane	2	2	4	8%
Walla Walla	0	2	2	4%
Issaquah Class 1980s				
Cathlamet	0	2	2	4%
Chelan	17	1	18	35%
Issaquah	12	2	14	27%
Kitsap	3	0	3	6%
Kittitas	2	3	5	10%
Sealth	6	2	8	15%
Jumbo Mark II Class 1990s				
Puyallup	2	1	3	6%
Tacoma	14	2	16	31%
Wenatchee	18	2	20	38%
Total	**107**	**47**	**154**	
Average	**5**	**2**	**7**	**13%**

Source: WSF Vessel Maintenance Lay-up Schedule Revised 10/22/07
Does not include emergency repairs to Steel Electric class vessels – just planned maintenance.

The table in Appendix B shows the planned time out of service for the vessel preservation program for active vessels from FY 06-FY 11, which does not include out of service time for maintenance tie-ups at Eagle Harbor. This table shows the following:

- ***Out of Service Time:*** Vessels are out of service for preservation work a total of 3,731 days during this 6 year period. This means on average of nearly two boats are out of service per day for preservation work, with vessels out of service an average of 30 days per year for preservation work.
- ***Out of Service Time by Class:*** By vessel class, at least one active boat in a class is out of service for preservation work 4 percent of the time (*Rhododendron)* to 51 percent of the time (Super class).
- ***Seasonal:*** While most preservation work is done in the fall, winter, and spring, between June 1 and Sept. 1 of these years, the high travel summer season, vessels are out of service 703 days, representing 117 out of service summer days per year.

J. Consultant Observations and Recommendations

1. Steel Electric and Rhododendron Replacement Recommendations

WSF plans to replace the Steel Electric vessel assigned to the Anacortes inter-island route and the *Rhododendron* through implementation of its new 144-car vessel program (see Section IV for more discussion of the new 144-car vessel program). The deployment of the new 144-car vessels throughout the system results in the retirement of these two older vessels and their replacement on the inter-island route and the Pt. Defiance-Tahlequah route with 87-car Evergreen State class vessels built in the 1950s.

The new vessel program will not retire the two Steel Electric class vessels on the Port Townsend-Keystone route, and there are no other vessels in the existing WSF fleet capable of entering the Keystone harbor. WSF had considered moving the location of the Keystone harbor to allow larger vessels on the route. The decision has been made not to move the harbor.

In 2007, the legislature allocated $1 million to support combined route planning for the Port Townsend-Keystone route during the 2007-09 biennium. Vessel options are to be presented to the legislature by January 2008, with design development following.

The goal of the vessel planning study portion of the Port Townsend-Keystone route plan is to develop new vessel options to replace the Steel Electrics on the route. All vessel options must be under 100 cars and be capable of operating within the existing harbor (Steel Electric Vessels Draft Tactical Plan, Oct. 1, 2007, pp. 7-8).

WSF originally identified nine viable vessel options – all of which are new ships with capacities of 60, 80 and 100 cars. For each capacity, WSF has considered a monohull or catamaran hull form, and a conventional and extra maneuverable propulsion system (Steel Electric Alternatives, Oct. 1, 2007). Additional options were added as emergency conditions developed on the Port Townsend-Keystone route. The total numbers of options being explored as of the time of this report is fourteen, including one suggested

by the consultants. (The consultants suggested and WSF reviewed an option to transfer the superstructure of the existing Steel Electric vessels onto a new hull.)

a. Replace active Steel Electric class vessels and Rhododendron expeditiously

The consultants recommend that the three active Steel Electric vessels and the *Rhododendron* be replaced as expeditiously as possible given: 1) the large emergency expenditures being incurred; 2) the potential lifting of the COI for continued operation of these ships; and 3) the decision to pull all Steel Electric vessels from service in November for extensive steel repairs. The most critical need is to replace the two Steel Electrics assigned to the Port Townsend-Keystone route.

The consultants recommend that replacement of the Steel Electric class vessel and the *Rhododendron* be considered the top priority for WSF capital funding. This could either be accomplished by building or retrofitting two new vessels for the Port Townsend-Keystone route and utilizing the first two new 144-car vessels to replace the Steel Electric class vessels on the inter-island route and the *Rhododendron,* or by building or retrofitting four smaller vessels.

b. Expedite Steel Electric and Rhododendron replacement procurement process

In order to expedite procurement of the replacement Steel Electric vessels for at least the Port Townsend-Keystone route the legislature should consider changes in the procurement process.

Any procurement process changes should take into consideration the existing design-build authorization and the modifications made to expedite the current 144-car vessel procurement. See Appendix C for the 144-car vessel procurement process.

2. Consider Rebuild of Hyak

The consultants recommend that an economic analysis be undertaken to determine whether it would be cost-effective to re-build the *Hyak* to have the vessel's life extend to the same as the other Super class vessels. This is particularly important given the recent and planned investments in the *Hyak*.

3. Reduce Drydock and other Planned Out of Service Times

If out of service times can be substantially reduced, fewer vessels will be required in the fleet to provide maintenance and standby service to cover the out of service periods. Additionally, ferry customers will not be subject to the inconvenience of having smaller than normal vessels on a route during such maintenance, which occurs, for example, when the Jumbo Mark II vessels are out of service. Specific ways this might be accomplished include:

a. Reviewing shipyard contracts

WSF should review its contracts with shipyards to ensure they have both preferential rates and schedules, reflecting the relatively large size of WSF as a shipyard customer. A large cruise ship line reports that its average time for a 900 foot cruise ship in Washington State to paint and inspect the bottom, paint the entire topsides, check shafting and replace seals if necessary, and do all other USCG/ABS work is one week.

b. Preservation work while underway

Cruise lines also do some preservation work while the vessel is underway. For example, they will lay a pipe next to a functioning pipe, doing all preparation work while underway and the final hook-up done during a layover. Given the time WSF vessels spend in dock on a daily basis, out of service time could be reduced by doing preservation work while underway**.**

4. Maintenance and Preservation Recommendations

a. Institute a bilge and void maintenance program

The consultants noted bilge and void maintenance problems in every older ship they visited. Some present bilge maintenance is carried out by the vessels' engineers during off time with chipping hammers and applying alkyd paint with brushes. WSF should institute a formal bilge maintenance program to prevent deterioration of the hull interior, which has been one of the problems in the Steel Electric class vessels. If combined with an integrated coating program (see below), bilge maintenance should not add additional costs.

b. Institute a visual inspection/audio gauging steel preservation program for older vessels

The consultants recommend that WSF institute a detailed process of internal visual inspection of its vessels once they reach 20 years of age for pitting or cracking, with audio gauging of suspect areas and then remedial coating, or replacement, of the suspect areas. This will require extra expense in gauging, but can provide early detection of steel integrity problems.

When vessels exceed about 20 years of age, untreated corrosion can get to the point that plate replacement is required. In lower, inaccessible areas of the hull, chemicals and water standing in these low bilges accelerates corrosion. All of the water and material cannot be removed due to the shape of the hull, so the only method of combating the corrosion is inspection and re- coating (painting) where necessary.

Audio gauging measures the thickness of plating and by comparing readings to the original plate thickness one can determine how much of the plate has corroded away, or how much has been "wasted". Generally 25 percent wastage is considered enough to require plate renewal.

Audio gauging readings are only taken in a few spots, on a steel plate that might be 200 square feet in size, thus the few measurements are only indicative of the plate condition, but wastage could be much worse than detected by the gaugings. Additionally, audio gauging does not show cracks in plate. Corrosion and plate cracking are progressive problems. Once a plate surface becomes severely corroded the surface becomes cratered and traps more water than a smooth plate, accelerating corrosion. Similarly, cracks occur in plating due to stresses in the structure. Re-welding a few initial cracks prevents further cracking, but cracks left alone promote more cracking as there is less structure to support the load as some of the structure has become cracked.

The only way to predict this accelerated cracking is by pin pointed audio gauging that results from detailed visual inspections. Then, with remedial coating, or repair progressive cracking can be controlled.

c. Institute an integrated coating program

Vessel coating (painting) is a critical part of vessel preservation, involving both considerable cost and time in shipyards and in drydock. WSF uses four bottom paint and four topside paint systems all using different paint manufacturer's products. WSF has been internally evaluating these painting systems since 2000. The warranties that are extended are for a period of one year from the shipyard for paint application and one year for the paint itself by the paint vendor. The paint vendor warranty only covers the replacement cost of the paint, not the cost of application.

The present system of using many paint suppliers with individual projects being administered by different WSF personnel leaves no central responsible party for the performance of the coating system. If the system fails after one year, or has to be re-coated in advance of the intended recoating period, the recoating is simply carried out.

It is common practice for fleet owners to contract for the preservation of their fleet with one coating manufacturer. The coating manufacturer is brought in to survey all existing vessels and a long term program is developed to provide the proper product for the application, the proper preparation of the surface to be coated, and the proper application method. Usually, an account manager is assigned from the manufacturer and, depending on fleet size, either part time or full time inspection and paint technicians are assigned to the fleet.

The advantage of contracting with a large, reputable vendor is that they coat thousands of vessels and are continually developing the products and process based upon their experience. Most owners contract with some type of warranty against coating failure; i.e. if a coating fails within one year the supplier is 100% responsible for the cost of recoating, after 2 years, 80% responsible, etc. Current products, properly prepared and applied, by industry standards should last between 5 and 10 years in the general routes of WSF, however there are some routes where performance will not be this good. It would be too costly to implement the program by simultaneously recoating every vessel so such a program could take a number of years to fruition, however most owners who track costs report better coating performance at a lesser fleet cost. Therefore, a coating program that uses superior products and involves a reputable vendor in part of the risk is recommended for WSF's consideration.

There are superior coating systems that should be used in new construction, in particular, inorganic zinc primers. This primer combined with proper pre-application surface preparation and rounding of edges will support at least 10 years, and as much as 15 years, of nearly corrosion free service. Epoxies and urethanes provide long term protection to these primers, as left exposed the primers would cathodically disappear. Epoxies and urethanes are more difficult, however, to recoat as they are hard and require blasting to etch them before recoating.

A coating system program would include:

- **Bidding out WSF paint supply:** A single bid to supply WSF paint for both maintenance and preservation could be developed. As part of the bid, WSF could require that the supplier provide a guarantee against coat failure, with the vendor required to repaint in the event of early failure of the coating.
- **Testing coatings:** WSF could also allow the selected vendor to paint small parts of a vessel with different coatings to determine which coating works best. These test patches can be applied adjacent to one another to judge individual product performance under identical conditions. The current practice of trying new products on whole structures is expensive if the coating does not perform as expected.
- **New construction specification:** WSF should specify paint requirements for new construction that include the above referenced inorganic zinc primers and top coatings in conjunction with recommendations from the fleet coatings vendor. The optimum is to use that supplier's coatings in new construction specifications, if possible.
- **Supply preservation coating material:** When using a shipyard for painting, WSF should consider supplying the paint. While there is some contractual risk with the shipyard applying owner supplied paint, with proper supervision from the paint supplier, the results are usually still better than allowing the shipyard to supply the paint.
- **Prioritizing preservation coating:** Some of the painting that WSF does, particularly in the cabins and topside, is not necessary for structural preservation and done to maintain vessel appearance. WSF indicates that vessel cabins are painted at the time of new interior installations only. Non-preservation coating should be secondary to bilge and other coatings essential to vessel preservation.

d. Consider standardized cabin maintenance materials

On their vessel tours the consultants noted that the vessels do not all use the same maintenance supply providers or equipment for cabin areas. Staff noted to the consultants that as they rotate between vessels the variance in products makes it more difficult to maintain the vessels. WSF should consider moving to a more standardized approach to maintenance products and procedures to improve staff training.

e. Provide preservation funding for inactive vessels or retire them out of the fleet

If vessels are to be kept in the WSF fleet, full preservation funding should be provided. Without adequate preservation funding, emergency funding must be used to either keep vessels ready for activation and/or to activate (see discussion in the next Section). Planned preservation of these ships, particularly the *Hiyu*, which is in very good condition, will enable WSF to have these ships truly available as "deep reserves" for system contingencies. The consultants believe that if inactive vessels were kept in a preservation state consistent with active vessels, that a fewer number of inactive vessels would be required to be maintained in the fleet. Properly preserved inactive vessels could be relied upon to provide reliable back up service. If these inactive vessels are not be preserved, they should be considered for retirement out of the system.

Section IV.
Vessel Replacement

The projected replacement dates of the active vessels should be the driver for the vessel preservation and maintenance program, with the goal to maintain vessels to be fully operational for their expected life spans, while not over-investing in vessels that are scheduled for replacement. The total maintenance, preservation, and emergency budgets should be tied to new vessel in-service dates and existing vessel phase-out dates. A comprehensive replacement plan is key to determining the financing necessary to preserve existing ferry capacity, to avoid service disruptions or diminutions, and to avoid emergency procurement conditions.

This section reviews WSF's current vessel replacement planning, rebuild/replacement experience, capacity additions to existing vessels, new vessel deployment plan, vessel replacement needs, and the relationship between vessel, terminal, and shoreside improvements. This section also includes consultant observations and recommendations on the development and presentation to the legislature of a consistent vessel rebuild/replacement plan and a vessel deployment plan that integrates terminal, vessel, and shoreside improvement planning, scheduling and budgeting, and the development of route based capital budgets.

Most importantly this section concludes that WSF will be faced with replacing 18 of its existing 21 active vessels during the next 36 years – representing 77 percent of existing auto capacity. Vessel replacement will be a critical variable in future ferry financing.

A. WSF Vessel Replacement Planning

1. Expected Service Life – 60 years

The expected life of WSF's auto-passenger ferries is 60 years. The decision to retire a specific vessel is "based on economic analysis using life cycle cost methodology" (WSF, Vessel Retirement Planning, updated Oct. 2007).

WSF's use of 60 years for the life of a vessel is based on the following considerations:

- ***System replacement costs:*** Vessel preservation costs are the highest at the 60-year point because of the need to replace a large number of systems.
- ***Impact of technological change:*** Because of new technology, replacing some systems at 60 years may require replacing other systems to be compatible with the technology.
- ***Reduced hull integrity:*** By approximately 60 years, salt-water corrosion to the hull makes it too expensive to maintain a vessel in seaworthy condition.
- ***Changes in service needs:*** The basic characteristics of a vessel are not easily changed to meet the changes in service needs likely over the long term.

- ***No resale value:*** WSF auto-passenger ferries are not suitable for use on most other international or United States ferry routes.

In short, after about 60 years, it becomes economically impractical to preserve a vessel.

2. Rebuild

For all vessels except the six Issaquah class vessels built in the 1979-1980 time period, WSF assumes that the vessel is to be rebuilt halfway through its life, i.e., at the 30-year mark. This rebuild includes major renovations to replace between 45 and 75 vessel systems, each of which has its own life cycle. For the Issaquah class vessels, WSF is conducting periodic major maintenance rather than one large re-build, but the expected service life remains 60 years.

B. WSF Rebuild/Replacement Experience

As shown in the table below, WSF has not been able to adhere to the 60-year life/30-year rebuild model in its fleet replacement program for its older vessels. The six Issaquah class vessels (not due for rebuilding because of ongoing major maintenance), and the three Jumbo Mark II vessels (only 9 and 10 years old), are not included in this analysis.

The three active Steel Electric vessels were first rebuilt in 1957 and again between 1981 and 1987, when they were already nearing or at 60 years of age. The *Rhododendron* was rebuilt in 1991 when the vessel was 44 years old. The two active Evergreen State vessels were rebuilt close to the preferred 30 year schedule, as were three of the four Super class vessels and all of the Jumbo Mark I class vessels.

One Super class vessel, the *Hyak* (built in 1967), was not rebuilt. As a consequence that vessel is scheduled for retirement 15 years early (2010-15 instead of 2027-32). The planned retirement date range means that the *Hyak* will have 45 to 50 years of service with no rebuild. Based on its condition, the consultants have recommended that a cost-benefit analysis be conducted to determine whether the *Hyak* should be re-built to last as long as the other Super class vessels.

One vessel, the *Elwha,* was rebuilt six years early in order to meet SOLAS requirements. As a consequence, WSF has a retirement date range for the *Elwha* that is two to three years earlier than the *Kaleetan* and *Yakima,* its sister Super class vessels.

The three inactive vessels have distinct rebuild histories. The *Evergreen State* was rebuilt in 1988, the Steel Electric class *Nisqually* was re-built at age 60 in 1987, and the *Hiyu* built in 1967, has not been rebuilt.

Table 7.
WSF Active Vessel Rebuild and Retirement Schedule

Class	Active Vessel	Built Date	Target 30 Year Rebuild Date	Actual Rebuilt Date	Years Diff.	Retire Alternate: Rebuilt + 25 or 30 Yrs*	Scheduled Retirement Date Range
1920s							
Steel Electric	Illahee	1927	1957	1986*	**+29**	2011	2011-15
	Klickitat	1927	1957	1981*	**+24**	2006	2008-13
	Quinault	1927	1957	1985*	**+28**	2010	2010-15
1940s							
Misc	Rhododendron	1947	1977	1991	**+24**	2021	2011
1950s							
Evergreen State	Klahowya	1958	1988	1995	**+7**	2025	2023-28
	Tillikum	1959	1989	1994	**+5**	2024	2022-27
1960s							
Super	Elwha	1967	1997	1991	**-6**	2021	2025-30
	Hyak	1967	1997	--		--	2010-15
	Kaleetan	1967	1997	1999	**+2**	2029	2027-32
	Yakima	1967	1997	2000	**+3**	2030	2028-33
1970s							
Jumbo Mark I	Spokane	1972	2002	2004	**+2**	2034	2032-7
	Walla Walla	1973	2003	2003	**-**		2031-6

* Steel Electrics originally rebuilt in 1957. 25 years assumed life for 2nd rebuild.

C. Capacity Additions to Existing Vessels

WSF has added capacity to five of the six Issaquah class vessels by adding a second deck between 1979 and 1981. This addition expanded the vehicle capacity on each vessel from 90 to 124. The *Sealth*, which is assigned to the Anacortes based routes in the winter and is a maintenance vessel in the summer, did not undergo the capacity increase.

D. New Vessel Deployment Plan

The 2007-09 financial plan includes $347.6 million to build four 144-car vessels, including expenditures from previous biennia. The vessels are planned for delivery beginning in 2011 assuming a 14-month delivery from the shipyard for the first ship after contract signing, and a subsequent nine-month delivery for each vessel thereafter. The fourth vessel under these assumptions would be delivered in 2015. The vessel procurement is currently entering phase II of the design-build process. (See Appendix B for further explanation.)

WSF's deployment plan for the four new vessels results in the retirement of one active Steel Electric vessel assigned to the Anacortes based inter-island route (new vessel #1), the *Rhododendron* assigned to the Pt. Defiance route (new vessel #2), and the *Hyak* (new vessel #4). The third new vessel replaces the inactive *Evergreen State*. The deployment plan moves the *Elwha,* which is due for retirement in 2025-2030, to a de-crewed, inactive status during the fall, winter, and spring.

As planned, the new vessels will add 7 percent—176 vehicles—to the system's active auto capacity in the fall, winter, and spring, and will decrease the inactive de-crewed vessel capacity by 1 percent. The new vessels will add 12 percent—320 cars—to the active auto capacity in the summer, and will decrease the inactive de-crewed vessel capacity by 81 percent, leaving only the *Hiyu* in an inactive status during the summer.

Table 8.
New 144-Auto Vessel Capacity Change
(Change from Retirement of Existing Vessels and Addition of New Vessels)

Class	Vessels	Auto Capacity Fall, Winter, Spring Change	Auto Capacity Summer Change
	Active Vessels		
Steel Electric	Klickitat	-64	-64
Misc.	Rhododendron	-48	-48
Super	Hyak	-144	-144
Super	Elwha	-144	
New (4)	144 cars	576	576
Net		176	320
Current Active Auto Capacity		2,672	2,672
% Increase		7%	12%
	Inactive Vessels		
Steel Electric	Nisqually	-59	-59
Evergreen State	Evergreen State	-87	-87
Super	Elwha	144	
Net		-2	-146
Current Inactive Auto Capacity		180	180
% Decrease		-1%	-81%

E. Vessel Replacement Need

Based on WSF's projected retirement dates that were updated in October 2007, WSF must plan for the replacement of 18 of its 21 active vessels between 2008 and 2044. In other words, WSF needs to be replacing or planning the replacement of 77 percent of its existing auto capacity in the next 36 years. Vessel replacement will be a critical variable in future ferry financing. New vessel planning, design, procurement, and construction takes approximately 10 years. (The current 144-car vessel procurement was first authorized in the 2002 legislative session with ship delivery planned between 2011 and 2015.)

As shown in the table below, WSF has a foreseeable vessel replacement requirement that should be the basis for future planning and financing

Table 9.
Vessel Replacement Needs 2008-2044

Class	Vessel *Replace in new vessel program	Vehicle Capacity	Year Built / Rebuilt	Current Route and Season	Retirement Range**
1920s: Replace 3, 2008-2015					
Steel Electric	*Illahee**	59	1927 / 1986	Anacortes-all	2010-15
	Klickitat	64	1927 / 1981	Keystone-all	2008-13
	Quinault	59	1927 / 1985	(maint-FWS) Keystone-Su	2010-15
1940s: Replace 1, 2011					
Misc.	*Rhododendron**	48	1947 / 1991	Pt Defiance/Tahlequah-all	2011
1950s: Replace 2, 2022-28					
Evergreen State	*Klahowya*	87	1958 / 1995	Fauntleroy/Vash/South-all	2023-28
	Tillikum	87	1959 / 1994	Fauntleroy/Vash/South-all	2022-27
1960s: Replace 1, 2010-15, and 3, 2025-2033					
Super	*Elwha*	144	1967 / 1991	Anacortes-all	2025-30
	*Hyak**	144	1967 / --	(maint-all)	2010-15
	Kaleetan	144	1967 / 1999	Seattle/Bremerton-FWS, Anacortes-Summer	2027-32
	Yakima	144	1967 / 2000	Anacortes-all	2028-33
1970s: Replace 2, 2031-37					
Jumbo Mark I	*Spokane*	188	1972 / 2004	Edmonds/Kingston-all	2032-37
	Walla Walla	188	1973 / 2003	(maint-FWS) Seattle/Bremerton-Su	2031-36
1980s: Replace 6, 2037-2044					
Issaquah	*Issaquah*	124	1979 / ongoing	Fauntleroy/Vash/South-all	2037-42
	Kitsap	124	1980 / ongoing	Seattle/Bremerton-all	2038-43
	Kittitas	124	1980 / ongoing	Mukilteo-all	2038-43
	Cathlamet	124	1981 / ongoing	Mukilteo-all	2039-44
	Chelan	124	1981 / ongoing	(maint-FWS) Anacortes-Su	2039-44
	Sealth	90	1982 / ongoing	Anacortes-FWS (maint.-Su)	2040-45
Replacements 2008-2044 (36 years) 18 Vessels/2,066 vehicle capacity/77% current auto capacity					

* WSF New Vessel Deployment Plan – Sept. 21, 2007
** Revised by WSF October 2007

Key:
FWS = fall, winter, spring; Su = summer; All = all seasons

F. Relationship of Vessel, Terminal, and Shoreside Improvements

The ferry finance model shown in Section I assumes that vessel decision-making drives terminal improvements. The interactive nature of the model is clear when assessing the relationship between vessel changes, terminals, shoreside improvements, and community reaction. The Port Townsend-Keystone run shows the importance of route based planning that considers the vessel, terminal, shoreside improvements, and community reaction on both sides of the route when considering vessel capacity changes.

Replacement of the Steel Electric class vessels on the Port Townsend-Keystone route was originally assumed to be with larger vessels. "The root need for examining alternatives to the existing Keystone terminal and Port Townsend terminal is WSF's decision to replace its 76-year-old Steel Electric class vessels, the only WSF vessel class that can use the existing Keystone harbor. … Keystone harbor and the existing facilities at both Keystone and Port Townsend need to be either upgraded to accommodate the Issaquah 130 Class or other vessel with similar characteristics … or the terminals need to be relocated and redeveloped at an alternative site where the navigational and upland holding and ingress/egress requirements of the replacement vessels can be more effectively accommodated" (WSF Purpose and Need Port Townsend-Keystone Report Nov. 24, 2003, p. 2).

From 2003 to 2006, WSF had separate planning processes for the Port Townsend and the Keystone terminals/vessels. In 2006 it became apparent that the Port Townsend community would not accept the impact on the community's streets from bringing larger vessels into the terminal and that the Keystone harbor move was not financially and environmentally feasible. This led to the joint route planning effort for which the legislature appropriated $1 million in the 2007 legislative session (see discussion in Section III).

The delays in replacing the Steel Electric vessels on the Port Townsend-Keystone route have exacerbated the need for urgent procurement of replacement vessels.

G. Consultant Observations and Recommendations

1. Develop Consistent and Legislatively Reviewed Vessel Rebuild/Replacement Plan

WSF does not have a consistent vessel replacement plan. The vessel replacement dates in this study were updated by WSF in October and are not consistent with the retirement dates carried in WSF's LCCM. For example, the LCCM assumes that the Steel Electric class vessels would be retired in the 2009-11 biennium, a time period during which there is no plan to replace the two Steel Electric class vessels on the Port Townsend-Keystone route.

Because WSF does not have a consistent vessel replacement plan, they do not have a solid and consistent framework for preservation, maintenance, and operating budget decisions. The consultants recommend that WSF be required to submit to the legislature a baseline vessel rebuild/replacement plan that includes:

- ***Projected retirement dates*** for all vessels, distinguishing between active and inactive vessels.
- ***Projected rebuild dates*** for all vessels except the Issaquah class vessels, for which a status report on major maintenance should be provided.
- ***Explanation of significant deviations*** from the plan, including:
    - *Decisions not to invest in vessels*. Decisions not to invest in the rebuild of a vessel are as important as decisions to invest. For example, the *Hyak* is anticipated by WSF to have only a 45-year instead of a 60-year life because of the decision not to invest in a rebuild of the vessel.
    - *Decisions to invest early in vessels*. A decision to invest in a rebuild earlier than anticipated is also an important decision, with consequences for how long the vessel will operate. An example of this is the early investment in the *Elwha,* which may have been justified by circumstances but will also have the effect of an earlier retirement timeframe than the other vessels in the Super class.
- ***Summary of vessel condition*** for all vessels, distinguishing between active and inactive vessels. This summary should highlight any significant deviations from the norm, such as poorly functioning machinery that might affect the continued operation of the vessel, and include a steel assessment.
- ***Tie the requested vessel preservation budget*** to the replacement and rebuild plan. Providing adequate preservation budgets on an ongoing basis is critical to having vessels fulfill their 60-year service lives. Preservation funding can be reduced in the five years prior to replacement of a ship, but should not be reduced until actual construction on the replacement has commenced.
- ***Treat the replacement plan as a baseline*** to replace existing capacity. Future capacity additions can be added, but it is important to keep as a base what is minimally required to maintain existing capacity.
- ***Show full timelines for replacement*** including business decisions, design, procurement, and construction.
- ***Business decisions on vessel sizing*** should be explicit and presented to the legislature before proceeding with design, procurement, and construction.
- ***Prioritize vessels that replace existing capacity in-kind over increases in capacity*** if both cannot be financed.

Figure 2 provides a sample baseline showing the replacements needed for the existing active vessels and the 10-year planning window for replacement planning, design, procurement, and construction. This sample assumes that the *Hyak* is rebuilt to retire at the same time as the rest of the Super class vessels.

2. Develop a Legislatively Reviewed Vessel Deployment Plan that Maximizes the Utilization of Existing Vessels.

WSF should submit to the legislature with the replacement and rebuild plan a vessel deployment plan that shows:

- ***Planned seasonal deployment and service*** by route.
- ***Planned maintenance deployment*** based on scheduled out-of-service drydockings, other planned maintenance activities and dockyard availability.

3. Relate Increases in Vessel Capacity to Ridership Forecast, Level of Service Standard, Operational Changes and Terminal Design Standards.

Beyond the increases in vessel capacity contemplated in the new 144-car vessel procurement plan, additional capacity should relate to the ridership forecast, level of service standard, operational changes and terminal standards as required by ESHB 2358. The capital plan, which is subject to the approval of the Washington State Transportation Commission (WSTC), must adhere to "a current ridership forecast, vehicle level of service standards, operational strategies and terminal design standards" (ESHB 2358, Sec. 13).

The deployment of the new 144-car vessels should be reviewed to ensure maximum consistency with the revised ridership forecast, vehicle level of service standards, operational strategies, and terminal design standards.

4. Consider Alternatives to New Vessel Construction to Increase Capacity.

In reviewing capacity changes, WSF should analyze changes in service that can be provided with the existing fleet (i.e., returning some service cuts made in 2001 in lieu of adding capacity) and the feasibility of adding capacity to existing vessels. The most obvious option is to analyze the cost and operational effectiveness of adding a second deck to the *Sealth*, which would bring that vessel to the same capacity as the other Issaquah class vessels. (WSF did not add the second car deck in order to carry over height vehicles in the San Juan Islands.) Another option would be to consider the procurement of a vessel built outside the United States to operate on the Sydney route, which would only be useful on the peak summer runs when the vessel assigned to that route is not used extensively on domestic runs. (Under United States law – the Jones Act – ships sailing between US ports must be United States flagged vessels. Ships that go between the United States and a foreign port can be foreign flagged vessels.)

5. Prioritize and Commit Vessel Replacement Funding.

Figure 2 shows the need for a continuous process for design, procurement, and construction of new vessels to maintain existing capacity. Funding this program should be the top priority, along with terminal preservation, for WSF capital resources after the replacement of the Steel Electric class and *Rhododendron* vessels. The WSTC and the JTC are both conducting ferry financing studies in 2008 – the WSTC to analyze potential revenue sources and the JTC to help determine the amount of required capital resources. These studies and legislative actions should recognize the critical need for replacement vessel funding.

6. Use Route-Based Planning

Vessel changes may require modifications to terminals and/or to roads in order to accommodate capacity changes that occur from either new vessels, modifications to existing vessels, or service changes. For example, WSF is reluctant to add additional service to Bainbridge Island because of the constraints on Highway 305 and community concerns when it operated a three-boat schedule. The terminal at Fauntleroy is unlikely to be expanded given restrictions imposed by the City of Seattle, which constrain the vessels that can use that terminal. As WSF has initiated with the Port Townsend-Keystone route plan and Environmental Impact Statement (EIS), WSF vessel planning should be route based with terminal, vessel, and shoreside planning, budgeting, and scheduling synchronized.

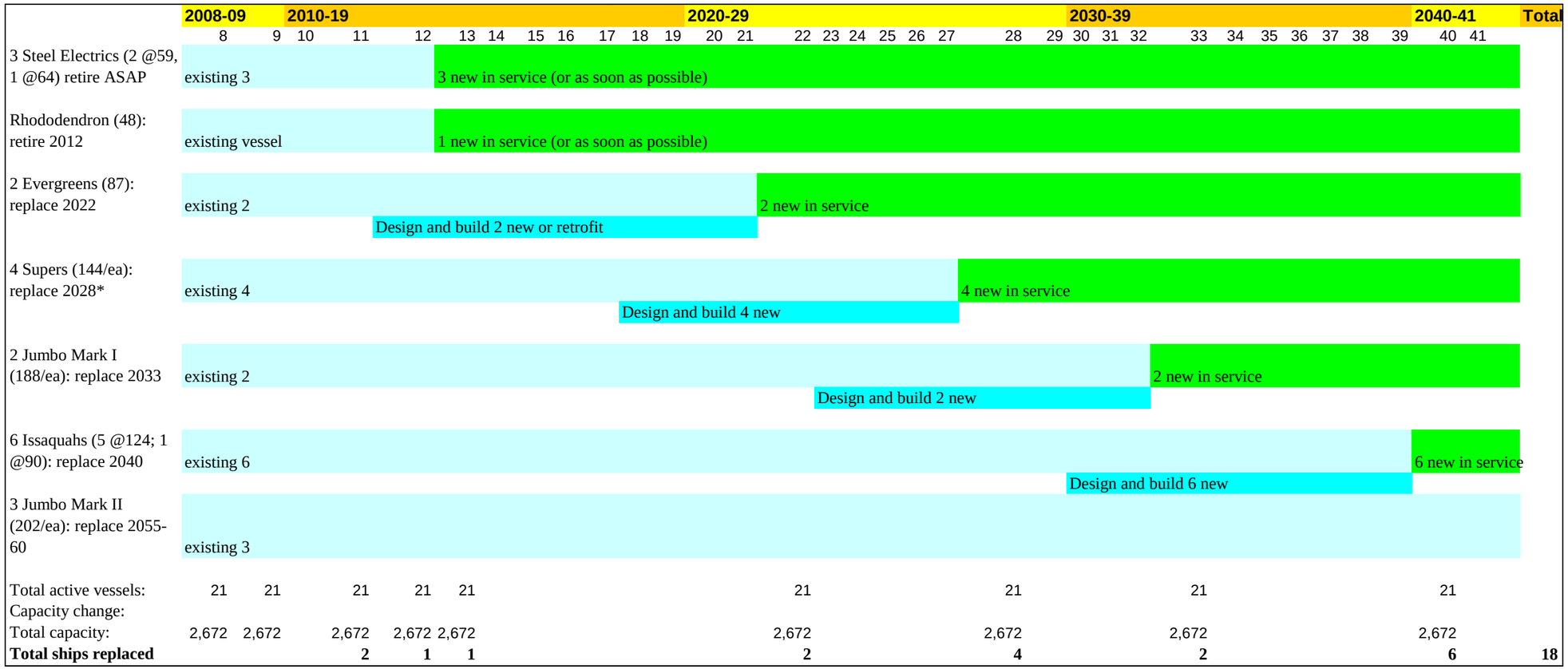
7. Gauge Community Reaction to Vessel Capacity Changes

ESHB 2358 requires an extensive outreach on the WSF capital plan, which should capture some concerns about changes in vessel capacity. In addition, WSF receives input from Ferry Advisory Committees. With route based planning, WSF should engage in substantial community interaction beyond the Ferry Advisory Committees to gauge concerns about changes in vessel capacities that might, as in the case of Port Townsend, significantly affect decision-making.

8. Present Route Based Capital Budgets

ESHB 2358 requires that WSF recognize the uniqueness of its travel sheds and routes in developing pricing and operating strategies. Route based vessel and terminal planning has been shown to be successful in recent initiatives in Port Townsend-Keystone. The legislature should consider requiring WSF to present its capital budget organized by route rather than by vessels and terminals. Separate lists of terminal and vessel projects do not provide as clear a frame of reference for assessing capital requests as a route based configuration.

Figure 2.
Sample Baseline Active Vessel Replacement Plan



Total active vessels:	21	21	21	21	21	21	21	21	21	
Capacity change:										
Total capacity:	2,672	2,672	2,672	2,672	2,672	2,672	2,672	2,672	2,672	
Total ships replaced			**2**	**1**	**1**	**2**	**4**	**2**	**6**	**18**

* Assumes Hyak retires with the rest of the class.

Section V.
Capital Financing

This section reviews the 2005-07 vessel biennium capital expenditures and the 2005-23 16-year capital plan.

Important conclusions are that the vessel capital funding provided in the 16-year plan (2007-23) is insufficient either to preserve the existing fleet or to replace vessels that are coming due for replacement during the plan period. The consultants recommend increased capital funding for vessels and that the legislature consider shifting funds from terminals to vessels.

A. 2005-07 Biennium Capital Expenditures

Vessel capital expenses for preservation and for new vessels are funded through the Puget Sound Capital Construction Account. For a description of the sources of such funding see *Washington State Ferries Financing Study Final Report, January 2007, Appendix 5.*

1. Total Vessel Expenditures

In the 2005-07 biennium, WSF expended $182.9 million in capital funds from the Puget Sound Capital Construction Account, of which 41 percent or $75.8 million was for auto-passenger vessels and 2.6 percent or $4.8 million was for auto-passenger vessel emergency repairs.[4]

Of the $75.8 million expended on non-emergency vessel projects, $32.9 million or 43 percent was for vessel preservation projects, $24.3 million or 32 percent was for new vessel acquisition, and $18.6 million or 25 percent was for systemwide projects.

Table 10.
2005-07 Capital Expenditures
(in $ millions)

	Actual Exp.	% of Total	% of Vessel Exp.
Terminals	102.0	56%	
Vessels	75.8	41%	
Vessel Preservation	32.9		43%
New Vessel Acquisition	24.3		32%
Systemwide Projects	18.6		25%
Emergency Repairs	5.1	3%	
Vessels	4.8		
Terminals	0.3		
Total	182.9		

Source: WSF Capital Project Expenditure Detail Report

[4] WSF also spent $0.2 million on passenger ferry preservation.

2. Existing Vessel Expenditures

Vessel capital expenditures are funded through individual vessel preservation projects, systemwide projects, and through emergency repairs. The table below shows the 2005-07 biennium capital expenses by vessel from these three types of projects. The systemwide project expenses included in this table are for work on specific vessels, which totaled $11 million of the $18.6 million in systemwide project expenses.

Table 11.
2005-07 Capital Expenses by Vessel
(in $ millions)

	Preservation Actual	Systemwide Projects	Emergency Repair	Total Expense	% of Total	% of Preservation	% of Systemwide	% of Emergency Repair
Steel Electric Class 1920s								
Illahee	0.4			0.4				
Klickitat	0.2	0.3	0.2	0.7				
Nisqually	0.1		0.4	0.5				
Quinault				0.0				
Sub-Total	0.7	0.3	0.6	1.6	4%	2%	3%	13%
Misc. 1940s								
Rhododendron	0.5	0.7		1.2	3%	2%	6%	0%
Evergreen State Class 1950s								
Evergreen State								
Klahowya	0.9	0.6		1.5				
Tillikum	0.9	0.7		1.6				
Sub-total	1.8	1.3		3.1	7%	5%	12%	0%
Super Class 1960s								
Elwha	6.2	1.4	2.1	9.7				
Hyak	6.5	0.9		7.4				
Kaleetan	2.8	0.6	0.1	3.5				
Yakima	0.4		0.1	0.5				
Sub-total	15.9	2.9	2.3	21.1	49%	48%	26%	49%
Misc. 1960s								
Hiyu			0.4	0.4	1%	0%	0%	9%
Jumbo Mark I Class 1970s								
Spokane	0.2	0.1		0.3				
Walla Walla	6.4	0.7		7.1				
Sub-total	6.6	0.8		7.4	17%	20%	7%	0%
Issaquah Class 1980s								
Cathlamet	0.2	1.2	0.2	1.6				
Chelan*	0.3	0.2		0.5				
Issaquah	1.0	0.4	0.2	1.6				
Kitsap	0.7	1.2		1.9				
Kittitas	0.2	0.8	0.1	1.1				
Sealth	4.6	0.9	0.2	5.7				
Sub-total	7.0	4.7	0.7	12.4	29%	21%	43%	15%
Jumbo Mark II Class 1990s								
Puyallup		0.1		0.1				
Tacoma	0.4		0.7	1.1				
Wenatchee		0.2		0.2				
Sub-total	0.4	0.3	0.7	1.4	3%	1%	3%	15%
Total	32.9	11.0	4.7	42.8				

Chelan preservation includes $85,000 SOLAS modification PIN
Source: WSF Capital Project Expenditure Detail Report/WSF Eagle Harbor Capital and Operating Maintenance Expense 2005-07

Vessel expenditures in the 2005-07 biennium were primarily for the Super class vessels built in the 1960s, with 49 percent of all vessel expenditures; the Issaquah class vessels built in the 1980s with 29 percent; and the Jumbo Mark 1 class vessels built in the 1970s with 17 percent.

The *Elwha* ($9.7 million), the *Hyak* ($7.4 million), the *Walla Walla* ($7.1 million), and the *Sealth* ($5.7 million) received 70 percent of the capital funding. Preservation funding for the *Elwha* and *Hyak* included major system upgrades, steel replacement, and a new elevator on the *Hyak.* The *Walla Walla* and the *Sealth* both had major interior preservation projects and the *Walla Walla* also had major mechanical and propulsion system upgrades.

See Appendix D for a more detailed discussion of preservation, systemwide, and emergency repair work on each vessel in the 2005-07 biennium.

3. Systemwide Projects

The table below shows the total systemwide expenditures in the 2005-07 biennium by project.

Vessel systemwide projects are for security infrastructure and planning ($7.5 million/40 percent of vessel systemwide expenses); vessel communications improvements ($5.1 million/27 percent); vessel projects including noise abatement, accessibility improvements, electrical projects, and maintenance projects that use the capital contracts on a reimbursable basis ($3.1 million/17 percent); and administrative functions ($2.9 million/16 percent).

Table 12.
2005-07 Vessel Systemwide Project Expenditures
(in $ millions)

PIN	Project Title	Exp.	%	$ Indiv. Vessel Exp.	% Indiv. Vessel Exp.	$ System Vessel Exp.	% System Vessel Exp
955570B	Vessel Physical Security Infrastructure	7.2	38%	5.6	78%	1.6	22%
955560K	Communication/Navigation/Life Saving	3.3	18%	1.1	33%	2.2	67%
955560M	Vessel Communications (IT)	1.6	9%	1.5	94%	0.1	6%
985550B	Vessel Projects	1.6	8%	1.3	81%	0.3	19%
955540H	Vessel Planning/Design	1.0	5%			1.0	100%
955540K	Vessel As-built Drawings Updates	0.6	4%			0.6	100%
955560N	Wireless Over Water	0.5	3%			0.5	100%
985550E	Vessel Contracts Using CAPS	0.5	3%	0.5	100%		
999976W	Vessel Noise Control (Abatement)	0.5	3%	0.5	100%		
955570A	Accessibility Modifications	0.5	2%	0.4	80%	0.1	20%
955570D	Vessel Physical Security Planning	0.3	2%			0.3	100%
955560L	Wireless Connections	0.2	1%			0.2	100%
955540M	Vessel Electrical Special Projects	0.2	1%			0.2	100%
955540I	Vessel Life Cycle Cost Model Update	0.1	1%			0.1	100%

PIN	Project Title	Exp.	%	$ Indiv. Vessel Exp.	% Indiv. Vessel Exp.	$ System Vessel Exp.	% System Vessel Exp
955570C	Vessel Safety Mgmt Enhancements	0.1	1%			0.1	100%
955560P	Wireless/Ferry Customers	0.1	1%			0.1	100%
999976V	Vessel Work Orders by Auditor	0.1	0%			0.1	100%
955540L	Vessel Environmental Studies	0.1	0%			0.1	100%
Total		**18.6**		**11.0**	**59%**	**7.7**	**41%**

a. Individual vessel systemwide projects

Of the $18.6 million WSF spent on vessel related systemwide projects in the 2005-07 biennium, $11.0 million or 59 percent was spent on individual vessels as shown in the table above and in the table on individual vessel capital expenditures. Projects that were primarily spent on individual vessels are:

- **Vessel Physical Security Infrastructure:** This $7.2 million security project is largely funded through federal grants. Seventy-eight percent (78%) of the project's expenditures were on direct vessel improvements, of which 37 percent was for Issaquah class vessels built in the 1980s, 22 percent for Super class vessels built in the 1960s, 17 percent for Evergreen State class vessels built in the 1950s, and 9 percent for the *Rhododendron* built in 1947. System expenditures were primarily for the purchase of a vessel access control and video monitoring system ($0.5 million).
- **Vessel Communications (IT)*:*** This $3.3 million project is state funded. In the 2005-07 biennium, 94 percent of the expenses were for individual vessel information technology improvements including the installation of local area networks and cell phone support. Forty percent (40%) of the direct project expenses were for communications information technology in the Issaquah class vessels built in the 1980s; 27 percent for Super class vessels built in the 1960s; 13 percent for the Evergreen State class vessels built in the 1950s; and 13 percent for the *Rhododendron* built in 1947. Expenditures that were not for individual vessels were to support wireless connections fleetwide ($129,000).
- **Vessel Projects:** This $1.6 million project is state funded. In the 2005-07 biennium, 81 percent of the expenditures for this project were for direct vessel projects. The primary expenditures were to buy spare parts for the Issaquah class vessels built in the 1980s ($723,000/54 percent), to support fuel monitoring studies ($240,000/15 percent), and to support miscellaneous work by state employees on vessels ($257,000/15 percent). System expenditures were for fleetwide engineering support ($41,000).
- **Vessel Contracts Using CAPS:** This is a state funded project that is administrative in nature. It allows WSF to use WSDOT's Contract Administration and Payment System (CAPS) to pay maintenance contractors. Maintenance contracts are initially set up in and paid by the WSF Construction Program W. The WSF Operating Program X (operating) reimburses Program

W. In the 2005-07 biennium, $0.5 million in maintenance projects were handled through this project involving 32 different maintenance work orders.

- **Vessel Noise Control (Abatement):** This is a state funded project. In the 2005-07 biennium all of the $0.5 million in expenditures were on individual vessels. Ninety percent (90%) of the expenditures were for noise abatement on the Issaquah class vessels built in the 1980s.
- **Accessibility Modifications:** This is a state funded project. In the 2005-07 biennium 80 percent of the $0.5 million in expenditures were on individual vessels. Ninety-nine percent (99%) of the direct expenditures were on Super class vessels built in the 1960s. Accessibility engineering accounted for the system expense in this PIN.

b. Systemwide projects – system support

Of the $18.6 million WSF spent on vessel related systemwide projects in the 2005-07 biennium, $7.7 million or 42 percent was spent on system support projects as shown in the table above. Projects that were primarily system support are:

- **Communication/Navigation/Life Saving**: This is a $3.3 million state funded project, with $15,000 provided in the 2005-07 biennium through a federal grant. In the 2005-07 biennium, 67 percent of the project expenditures were for system support. The largest system expenditures were for radar purchase and installation and navigation equipment support ($1.4 million/64 percent) and for the purchase of radio systems, automatic identification systems, automatic draft indicating systems, and life saving equipment ($0.8 million/36 percent). Individual vessels supported by this project were divided between the Evergreen State, Issaquah, and Jumbo Mark II classes.
- **Vessel Planning/Design**: This is a state funded project. In the 2005-07 biennium 100 percent of the $1 million expended was for system support. Work included vessel engineering planning and management ($0.5 million/50 percent), fuel conservation studies ($0.2 million/20 percent), autocad tools education ($0.1 million (10 percent), and Jumbo Mark II cavitation study ($0.1 million/10 percent).
- **Vessel As-Built Drawings Updates:** This is a state funded project. In the 2005-07 biennium, 100 percent of the $0.6 million expended was for system support work. As-built mechanical drawings ($0.3 million/50 percent) and as-built hull drawings ($0.3 million/50 percent) were the bulk of the work under this project.
- **Wireless Over Water and Wireless Connections***:* The wireless connections project has both state and federal funding and the wireless over water project is federally funded. The projects both support WSF's acquisition of high speed video data for a total expenditure $0.7 million in the 2005-07 biennium.
- **Vessel Physical Security Planning:** This is a state funded project. In the 2005-07 biennium, this project supported the ferry passenger partnership program ($.2 million/66%), a security education program for ferry and WSF security assessments and plan development support ($0.1 million/34%).

- **Vessel Electrical Special Projects:** This is a state funded project. In the 2005-07 biennium this project was used to develop vessel electrical line drawings ($0.1 million/50 percent of expenses) and to support the vessel antenna inventory and optimization effort ($0.1 million/50 percent).
- **Vessel Life Cycle Cost Model Update:** This is a state funded project that was used in the 2005-07 biennium to fund WSF staff working on the vessel life cost model at a total cost of $0.1 million.
- **Vessel Safety Management Enhancements:** This is a state funded project that was used in the 2005-07 biennium to fund a consultant environmental program manager at a total cost of $0.1 million.
- **Wireless/Ferry Customers:** This project is funded by a private contractor to support wireless service for customers on board WSF vessels. Expenditures were for WI-FI design and engineering and totaled $0.1 million.
- **Vessel Work Orders by Auditor:** This project funds WSF's internal vessel auditors, WSF staff responding to inquiries from external auditors, and payment for audited underpayment settlements. In the 2005-07 biennium, WSF spent $53,000 responding to external audits conducted in 2006 and spent $35,000 on internal vessel audits
- **Vessel Environmental Studies***:* This is a state funded project that was used in the 2005-07 biennium to fund a fuel oil heating study, an engine use study, and a vessel catalytic converter use study for a total cost of $0.1 million.

3. Emergency Repair

Of the $4.8 million in emergency repairs on vessels in the 2005-07 biennium, $4.7 million was spent on individual vessels. One hundred thousand dollars ($0.1 million) was spent on vessel crew endurance lighting. As described in the section on individual vessel expenses, the largest single emergency repair was the $2.1 million for the *Elwha*.

4. New Vessel

In the 2005-07 biennium, WSF spent $24.3 million on the new 144-car vessel procurement, with total expenses totaling $30.2 million since 2003. The table below shows the nature of these expenses and the status of the project.

Table 13.
New 144-Car Vessel Project Expense and Status
(in $ millions)

Category	Work Order	Contract Award	Contract Price	Total Exp. 2003 to 6/30/07	Biennium Exp 2005-07	Status
Preliminary Eng.	XL-1707	n/a	n/a	8.6	3.0	Complete
Pre-Contract Admin.	00-6674	n/a	n/a	0.6	0.6	Underway
Diesel Generators	00-6678	Jun-05	2.3	2.2	2.2	Complete
Propulsion Systems	00-6679	Apr-05	51.2	18.6	18.3	Design 99% ; Main Engines - Complete; Other parts in mfg & testing

Category	Work Order	Contract Award	Contract Price	Total Exp. 2003 to 6/30/07	Biennium Exp 2005-07	Status
PA, GA & PBX Systems	MS-5570	n/a	n/a	0.2	0.2	In storage
Total				30.2	24.3	

Source: WSF

Preliminary engineering is complete. The pre-contract administration has been for expenses incurred during phase II of the procurement process. The diesel generators are complete and the main engines have been completed and are in storage. The reduction gears, shafting, propellers, and other propulsion system components are being manufactured and tested. State workforce labor was used to develop the PA and PBX systems, which have been stored.

WSF design engineering staff have been heavily involved with this project. Expenses in the 2005-07 biennium are shown in the table below. Procuring the diesel and propulsion control systems account for 82 percent of the 2005-07 biennium expenses. Of the other 18 percent of costs, 64 percent is for WSF staff charging time to the project (including 5 percent for state force labor to make the PA, GA, and PBX systems), 23 percent for outside designers, 11 percent for design documents, and 2 percent for legal and community relations consultants.

Table 14.
New 144-Car Vessel WSF Staff Charges
(in $ millions)

	2005-07 Exp.	% non-mfg. costs	% total costs
WSF work group 60 & 70 staff*	2.6	59%	
Outside designers	1.0	23%	
Design documents	0.5	11%	
State force labor	0.2	5%	
Legal & community relations consultants	0.1	2%	
Total non-equipment costs	4.4		18%
Propulsion System Mfg.	17.8		73%
Diesel System Mfg.	2.1		9%
Total	**24.3**		

* Staff time can be charged under work order 60 which represents charges to the construction phase of a project or to work order 70 which represents charges to the design phase of a project. $2.1 million was charged to work group 70 and $0.5 million to work group 60.

B. 2005-07 Biennium Capital Expenses vs. Biennium Plan

WSF spent less on vessel capital in the 2005-07 biennium than anticipated by the legislature in the 2005 and 2006 sessions. The table below shows the appropriations for the 2005-07 vessel related projects from the 2005 and 2006 sessions and the actual biennium expenditures.

Table 15.
2005-07 Vessel Expenditures Planned vs. Actual
(in $ millions)

	05 Session	06 Session	Preservation Actual	05/Actual	06/Actual
Steel Electric Class 1920s					
Illahee	1.1	1.1	0.4	36%	36%
Klickitat	0.2	0.2	0.2	100%	100%
Nisqually			0.1		
Quinault					
Sub-Total	1.3	1.3	0.7	54%	54%
Misc. 1940s					
Rhododendron	2.1	2.1	0.5	24%	24%
Evergreen State Class 1950s					
Evergreen State					
Klahowya	1.9	1.5	0.9	47%	60%
Tillikum	1.9	1.9	0.9	47%	47%
Sub-total	3.8	3.4	1.8	47%	53%
Super Class 1960s					
Elwha	5.3	5.3	6.2	117%	117%
Hyak	4.7	5.1	6.5	138%	127%
Kaleetan	3.7	4.1	2.8	76%	68%
Yakima		0.3	0.4		
Sub-total	13.7	14.8	15.9	116%	107%
Misc. 1960s					
Hiyu					
Jumbo Mark I Class 1970s					
Spokane		0.4	0.2		
Walla Walla	3.2	5.6	6.4	200%	114%
Sub-total	3.2	6.0	6.6	206%	110%
Issaquah Class 1980s					
Cathlamet	1.4	0.9	0.2	14%	22%
Chelan	1.4	1.2	0.3	21%	25%
Issaquah	4.4	2.9	1.0	23%	34%
Kitsap	2.6	2.3	0.7	27%	30%
Kittitas	2.4	2.4	0.2	8%	8%
Sealth	6.2	4.1	4.6	74%	112%
Sub-total	18.4	13.8	7.0	38%	51%
Jumbo Mark II Class 1990s					
Puyallup					
Tacoma			0.4		
Wenatchee					
Sub-total			0.4		
Total Preservation	42.5	41.4	32.9	77%	79%
Total Systemwide	17	15.8	18.6	109%	117%
Emergency Repair*	4.1	4.0	4.8	117%	120%

	05 Session	06 Session	Preservation Actual	05/Actual	06/Actual
Sub-Total	63.6	61.2	56.3	88%	92%
New Vessel Construction		37.1	24.3		65%

* Total emergency repair appropriation from the 2005 and 2006 sessions. The $4.8 million in expense is for vessels only and does not include $0.3 million in expenses for terminal emergency repairs.

The preservation budget was under-spent by 21 percent from that anticipated in the 2006 legislative session, with under-spending for preservation of the Steel Electric class vessels (46 percent); the *Rhododendron* (76 percent); the Evergreen State class vessels (47 percent); and the Issaquah class vessels (51 percent). The preservation budget was over-spent for the Super class vessels (107 percent) and the Jumbo Mark I vessels (110 percent). Under-spending of vessel preservation funds is of particular importance on older vessels such as the Steel Electric class and the *Rhododendron*, and on the Issaquah class vessels that are to undergo periodic major maintenance rather than 30-year major rebuilds.[5]

The systemwide projects were overspent by 17 percent from the level of spending anticipated in the 2006 legislative session. The projects with the largest over-expenditures were largely federally funded ($0.8 million for physical security infrastructure and $0.7 million for wireless connections). State funded systemwide projects that spent more than anticipated by the 2006 legislative list include $0.5 million for navigation-communication-life saving improvements and $0.3 million more for vessel projects and for noise abatement projects.

The emergency repair budget, excluding the $300,000 spent on terminals, was 20 percent over the amount included in the 2006 legislative session project list.

C. 2005-07 Biennium WSF Staff and Design Capital Costs

The table below shows WSF staff charges to the vessel capital projects and the costs of outside design firms working on these projects.

Staff working on projects charge to work orders, with group 60 work orders for construction engineering and group 70 for design. Other staff charges are coded as maintenance project management, design, or state force labor. Eagle Harbor staff also work on capital projects.

Total staff charges to vessel capital projects in the 2005-07 biennium were $10.6 million, which represents 13 percent of all vessel capital expenses. Of the $10.4 million expended, $7.5 million or 71 percent was for charges to group 60 and 70; $2.5 million or 24 percent for other project management, design, or state force labor charges; and $0.6 million or 5 percent was for Eagle Harbor staff. Staff charges represented 14 percent of all preservation expenses, 15 percent of systemwide project expenditures, 8 percent of

[5] WSF indicates that significant investments in the Issaquah class vessels occurred during the 1999-05 time frame (replacing main engines, auxiliary generators etc.). As a result of this work, the 2005-07 biennium work would have been light on the Issaquah class vessels.

emergency repair expenses, and, as discussed above, 11 percent of new vessel expenditures.

Expenses for outside design firms, primarily naval architects, totaled $3.8 million in the 2005-07 biennium, which represents 5 percent of all vessel capital expenses. Of the $3.8 million expended on outside designers, $2.3 million or 60 percent was spent on systemwide projects, $1.0 million or 26 percent on new vessel design, $0.4 million or 11 percent on preservation projects, and $0.1 million or 3 percent on emergency repairs. Twelve percent (12%) of systemwide project expenses were for outside designers as were 4 percent of new vessel expenses, 2 percent of emergency repair expenses, and 1 percent of preservation expenses.

Combined staff and outside design expenses accounted for 18 percent of total vessel capital expenses, including 27 percent of systemwide expenses, 16 percent of new vessel expenses, 15 percent of preservation expenses, and 10 percent of emergency repairs.

Table 16.
WSF Staff and Outside Design Capital Costs
(in $ millions

	Exp.	Group 60 & 70	Misc. PM/Design	Eagle Harbor	Total Staff	%	Outside Design	%
Steel Electric Class 1920s								
Illahee	0.4	0.1			0.1	25%		
Klickitat	0.2	0.1			0.1	50%		
Nisqually	0.1							
Quinault								
Sub-Total	0.7	0.2	0.0	0.0	**0.2**	**29%**		
Misc. 1940s								
Rhododendron	0.5	0.1			**0.1**	**20%**		
Evergreen State Class 1950s								
Evergreen State								
Klahowya	0.9	0.1	0.2		0.3	33%		
Tillikum	0.9	0.0	0.1		0.1	11%		
Sub-total	1.8	0.1	0.3	0.0	**0.4**	**22%**		
Super Class 1960s								
Elwha	6.2	0.5			0.5	8%	0.1	2%
Hyak	6.5	0.6		0.1	0.7	11%	0.1	2%
Kaleetan	2.8	0.1	0.3	0.1	0.5	18%		
Yakima	0.4							
Sub-total	15.9	1.2	0.3	0.2	**1.5**	**9%**	**0.2**	**1%**
Misc. 1960s								
Hiyu								
Jumbo Mark I Class 1970s								
Spokane	0.2			0.1	0.1	50%		
Walla Walla	6.4	0.4			0.4	6%		
Sub-total	6.6	0.4	0.0	0.1	**0.5**	**8%**		

	Exp.	Group 60 & 70	Misc. PM/Design	Eagle Harbor	Total Staff	%	Outside Design	%
Issaquah Class 1980s								
Cathlamet	0.2	0.1		0.1	0.2	100%		
Chelan	0.3	0.1			0.1	33%		
Issaquah	1.0	0.2	0.2	0.1	0.5	50%	0.1	10%
Kitsap	0.7	0.1			0.1	14%		
Kittitas	0.2	0.1			0.1	50%		
Sealth	4.6	0.4	0.3		0.7	15%	0.1	2%
Sub-total	7.0	1.0	**0.5**	**0.2**	**1.7**	**24%**	**0.2**	**3%**
Jumbo Mark II Class 1990s								
Puyallup								
Tacoma	0.4	0.1			0.1	25%		
Wenatchee								
Sub-total	0.4	0.1	0.0	0.0	**0.1**	**25%**		
Preservation	32.9	3.1	1.1	0.5	4.7	14%	0.4	**1%**
Systemwide	18.6	1.4	1.2	0.1	2.7	15%	**2.3**	**12%**
Emergency Repair	4.8	0.4			0.4	8%	**0.1**	**2%**
New Vessels	24.3	2.6	.2		2.8	12%	**1.0**	**4%**
Total	80.6	7.5	2.5	0.6	10.6	13%	3.8	**5%**

D. 2007-09 Biennium and 16-Year Capital Financial Plan

1. Overview of 16-year plan

The 16-year transportation capital financial plan (2007-23) totals $2.238 billion for WSF, of which 55 percent or $1.236 billion is for terminals, 43 percent or $968.9 million is for vessels, and 2 percent or $63 million is for emergencies.

Of the $968.9 million planned for vessels, $608.1 million or 63 percent is for vessel preservation projects, $309.9 million or 32 percent is for new vessel acquisition, and $50.9 million or 5 percent is for systemwide projects. The new vessel acquisition funding is for four new 144-vehicle vessels to be delivered between 2011 and 2015.

Table 17.
2007-23 Financial Plan
(in $ millions)

	2007-23 Plan	%	% of Vessel Plan
Terminals	1,236.3	55%	
Vessels	968.9	43%	
Vessel Preservation	608.1		63%
New Vessel Acquisition	309.9		32%
Systemwide Projects	50.9		5%
Emergency Repairs	63.0	3%	
Total	2,268.2		

2. 2007-09 Biennium

For the 2007-09 biennium, the legislature reduced funding for terminals pending completion of studies required by ESHB 2358. Vessel capital funding of $202.4 million was appropriated, of which $142.8 million or 71 percent was for construction of the four new 144-car vessels, $48.9 million or 24 percent was for vessel preservation, and $10.7 million or 5 percent was for systemwide projects. Emergency repair funds of $6.4 million were appropriated for the 2007-09 biennium.

Table 18.
Capital Appropriation 2007-09 Biennium
(in $ millions)

	2007-09 Appropriation	% Vessel Appropriation
Total Vessel	202.4	
New Vessel Construction	142.8	71%
Vessel Preservation	48.9	24%
Systemwide Projects	10.7	5%
Emergency Repairs	6.4	

3. Preservation Projects

The 2007-09 appropriation and the 16-year plan for preservation projects for each vessel are shown in the table below.

Table 19.
Vessel Preservation Projects 2007-23
(in $ millions)

	07-09	%	07-23	%	05-07	Diff 05-07 & 07-09	Avg Biennium 07-23	Ave./Active Vessel * 07-23
Steel Electric Class 1920s								
Illahee	0.4		0.5		0.4			
Klickitat	0.1		0.1		0.2			
Nisqually	*Inactive - no capital*				0.1			
Quinault	0.1		0.1					
Sub-Total	0.6	1%	0.7	0%	0.7	-14%	LCCM retire 09-11	
Misc. 1940s								
Rhododendron	0.7	1%	0.8	0%	0.5	40%	LCCM retire 09-11	
Evergreen State Class 1950s - Retire 2022-2028								
Evergreen State	*Inactive - no capital*							
Klahowya	3.5		22.8		0.9			
Tillikum	2.2		18.5		0.9			
Sub-total	5.7	12%	41.3	7%	1.8	217%	5.2	2.6
*Super Class 1960s Retire 2025-2033***								
Elwha	1.9		44.4		6.2			
Hyak	2.3		12.5		6.5			

	07-09	%	07-23	%	05-07	Diff 05-07 & 07-09	Avg Biennium 07-23	Ave./Active Vessel * 07-23
Kaleetan	5.8		47.0		2.8			
Yakima	2.8		45.8		0.4			
Sub-total	12.8	26%	149.7	25%	15.9	-19%	18.7	4.7
Misc. 1960s								
Hiyu	*Inactive - no capital*							
Jumbo Mark I Class 1970s Retire 2031-2037								
Spokane	0.3		23.8		0.2			
Walla Walla	2.3		44.5		6.4			
Sub-total	2.6	5%	68.3	11%	6.6	-61%	8.5	4.3
Issaquah Class 1980s Retire 2037-44								
Cathlamet	0.6		34.4		0.2			
Chelan	1.0		34.4		0.3			
Issaquah	1.0		35.7		1.0			
Kitsap	1.0		37.6		0.7			
Kittitas	3.3		37.4		0.2			
Sealth	1.3		33.8		4.6			
Sub-total	8.2	17%	213.3	35%	7.0	17%	26.7	4.4
Jumbo Mark II Class 1990s								
Puyallup	5.6		40.9					
Tacoma	7.8		48.6		0.4			
Wenatchee	4.9		44.5					
Sub-total	18.3	37%	134	22%	0.4	4475%	16.8	5.6
Total	48.9		608.1		32.9		76.0	4.5

* Average for the 2007-23 biennium for 17 vessels that remain active during the biennium
** Assumes the Hyak is retired with the rest of the vessels in her class since the budget provides funding through the 2021-23 biennium.

Vessel preservation projects in the 16-year plan total $48.9 million for the 2007-09 biennium and $608.1 million for 2007-23 period. For each of the 17 vessels funded through 2021-23 in this capital program, an average preservation budget of $4.5 million per biennium is provided.

The 16-year plan reflects a shift in preservation funding to the Jumbo Mark II class vessels built in the 1990s, which will begin to need substantial preservation work.

- ***Inactive vessels***: No preservation funds are budgeted for the three inactive vessels: the Steel Electric class *Nisqually*, the *Evergreen State*, and *Hiyu.*
- ***Steel Electric class vessels and Rhododendron:*** Preservation funds for the active Steel Electric class vessels and the *Rhododendron* total $1.5 million for the 16-year plan. As will be discussed further below, the LCCM which formed the basis for the 16-year plan assumed that the Steel Electric class vessels would be retired in 2009-13 and that the *Rhododendron* would retire in 2011-13.
- ***Evergreen State class vessels:*** Preservation funds for the two active vessels in this class are increased from $1.8 million in the 2005-07 biennium to $5.7 million in the 2007-09 biennium. In the 16-year plan, these vessels receive an average of

$2.6 million per vessel per biennium and receive 7 percent of the capital preservation budget.

- ***Super class vessels:*** This class of vessels is funded at 19 percent less in the 2007-09 biennium that was expended in the 2005-07 biennium, reflecting reduced funding for the *Elwha* and *Hyak* that received substantial investments in the 2005-07 biennium. In the 16-year plan, these vessels receive an average of $4.7 million per vessel per biennium and receive 25 percent of the capital preservation budget.
- ***Jumbo Mark I class vessels:*** The two vessels in this class are funded at 61 percent less in the 2007-09 biennium than was expended in the 2005-07 biennium, reflecting reduced funding for the *Walla Walla* that received substantial investment in the 2005-07 biennium. In the 16-year plan, these vessels receive an average of $4.3 million per vessel per biennium and receive 11 percent of the capital preservation budget.
- ***Issaquah class vessels:*** The six vessels in this class are funded at 17 percent more in the 2007-09 biennium that was expended in the 2005-07 biennium, reflecting increased funding for the *Kittitas* and reduced funding for the *Sealth.* In the 16-year plan, these vessels receive an average of $4.4 million per vessel per biennium and receive 35 percent of the capital preservation budget.
- ***Jumbo Mark II class vessels:*** The three vessels in this class receive an increase in preservation funding of $17.9 million from the 2005-07 biennium to the 2007-09 biennium. As they enter their tenth year of service, the systems of these vessels are coming due for preservation. These vessels average $5.6 million per vessel per biennium in funding in the 16-year plan and receive 22 percent of the capital preservation budget.

a. Life cycle cost model (LCCM)`

WSF uses a life cycle cost model (LCCM) to determine the capital funding needed to preserve its vessels. As discussed in the section on vessel condition, the vessel life cycle cost model is based on an inventory of vessel systems and their anticipated service lives and renewal dates.

b. Vessel retirement/replacement planning and LCCM

One challenge in using the LCCM to plan the vessel preservation budget is to tie the model to the expected retirement date of the vessels. The life cycle cost model used in the 16-year financial plan uses assumed retirement dates for some vessels that do not correspond to WSF's most current stated retirement dates. These retirement dates also do not conform to the current deployment plan for the new 144-car vessels. The LCCM will be updated to correspond the new retirement dates when used to develop the 2007-09 capital budget.

The table below shows the scheduled retirement date for five active vessels and the last biennium for which there is a budget in the 2007-09 vessel life cycle cost model and in the 16-year plan.

The life cycle cost model for the Steel Electric vessels zeros out preservation funding before their actual retirement date. If they are to be kept in service, there will need to be some money to keep their systems operating. As discussed below, the emergency repair account has been extensively used for the Steel Electric class vessels in this biennium. For the *Hyak*, however, the opposite is true. The life cycle cost model shows expenses out to the 20021-23 biennium, eight to 11 years after WSF's planned retirement range of 2010-15.

Table 20.
LCCM and Retirement Dates

Class	Active Vessel	Built Date	Scheduled Retirement Date Range	Last Yr In Preservation Budget
Steel Electric	Illahee	1927	2011-15	2009-11
	Klickitat	1927	2008-13	2009-11
	Quinault	1927	2010-15	2009-11
Misc	Rhododendron	1947	2011	2009-11
Super	Hyak	1967	2010-15	2021-23

c. Inactive vessels and LCCM

The LCCM assumes no funding for vessels that are inactive. This means that when these vessels are deployed, emergency or operating maintenance funds must be used.

Table 21.
Inactive Vessels and LCCM

Class	Inactive Vessel	Built Date	Scheduled Retirement Date Range	Last Yr In Preservation Budget (07-23)
Steel Electric	Nisqually	1927	2008-13	n/a
Evergreen State	Evergreen State	1954	2010-15	n/a
Misc	Hiyu	1967	2008-13	n/a

d. Non-LCCM Costs

The vessel preservation budget for 2007-23 was developed before the passage of ESHB 2358 and includes funding for elements that under ESHB 2358 would be considered improvements. These expenditures include as-built drawings, antenna location analysis and modification projects, accessibility modifications, preservation reserves, and post retirement preservation costs. Non-LCCM costs total $2.8 million in the 2007-09 biennium or 6 percent of the vessel preservation project budgets and $14.2 million or 2 percent of the corresponding 2007-23 financial plan. WSF plans to, in conformance with ESHB 2358, classify these costs as vessel improvements in future capital budgets.

e. LCCM Update

WSF is currently updating the vessel LCCM to correspond to the requirements of ESHB 2358. ESHB 2358 Section 10 states that WSF must maintain a life cycle cost model that:

- Is used in developing preservation funding requests.
- Uses available industry standards or department-adopted standards when standard life cycles are not available.
- Is updated when inspections are made to reflect asset condition.
- Does not include systems that aren't replaced on a standard life cycle or that are not yet built.
- Is updated at least every three years.

4. Systemwide Projects

The table below shows the systemwide projects included in the 16-year plan. Reductions in systemwide projects reflect the end of federal funded programs for vessel physical security infrastructure and wireless communication after the 2007-09 biennium. State funded projects that are phased out during the 16-year plan include vessel as built drawings and accessibility modifications.

The average biennium expenditure for the systemwide projects that are active during the full 16-year plan period is $5.7 million per biennium.

Table 22.
Vessel Systemwide Projects 2007-23
(in $ millions)

PIN	Project Title	07-09	%	07-23	%	05-07	Diff 05-07 & 07-09	Ave Biennium* 07-23
955570B	Vessel Physical Security Infrastructure	3.5	33%	3.5	7%	7.2	-51%	1 biennium
955560K	Commo/Navigation/Life Saving	2.8	26%	27.1	53%	3.3	-15%	3.4
955560M	Vessel Communications (IT)	0.4	4%	1.6	3%	1.6	-75%	0.2
985550B	Vessel Projects	0.6	6%	5.1	10%	1.6	-63%	0.6
955540H	Vessel Planning/Design	1.0	9%	8.9	17%	1.0	0%	1.1
955540K	Vessel As-built Drawings Updates		0%		0%	0.6	-100%	
955560N	Wireless Over Water	0.1	1%	0.1	0%	0.5	-80%	1 biennium
985550E	Vessel Contracts Using CAPS	0.2	2%	1.6	3%	0.5	-60%	0.2
999976W	Vessel Noise Control (Abatement)	0.3	3%	0.3	1%	0.5	-40%	1 biennium
955570A	Accessibility Modifications		0%		0%	0.5	-100%	
955570D	Vessel Physical Security Planning	0.6	6%	0.6	1%	0.3	100%	1 biennium
955560L	Wireless Connections		0%		0%	0.2	-100%	
955540M	Vessel Electrical Special Projects	0.2	2%	0.2	0%	0.2	0%	1 biennium
955540I	Vessel Life Cycle Cost Model Update	0.2	2%	0.2	0%	0.1	100%	1 biennium
955570C	Vessel Safety Mgmt Enhancements	0.4	4%	0.4	1%	0.1	300%	1 biennium
955560P	Wireless/Ferry Customers		0%		0%	0.1	-100%	
999976V	Vessel Work Orders by Auditor	0.1	1%	0.8	2%	0.1	0%	0.1
955540L	Vessel Environmental Studies	0.3	3%	0.6	1%	0.1	200%	0.1
Total		10.7		51		18.6	-42%	5.7

5. New Vessels

The 16-year plan includes funding for four new 144-car vessels, the deployment of which will replace the Steel Electric class vessel on the Anacortes inter-island route, the *Rhododendron* on the Pt. Defiance-Tahlequah route, and the *Hyak*, if she is retired before the others in her class. The new vessel deployment will also result in the retirement of the inactive *Evergreen State* and Steel Electric class *Nisqually*.

No funds are included in the 16-year plan to replace the two Steel Electric class vessels on the Port Townsend-Keystone route, recommended by the consultants for top priority in capital funding. Nor is funding provided for replacement of the other vessels due for retirement by the 2021-23 biennium. Funding is also not provided for design of vessels that will be retired by 2033, which would need to be provided during the 16-year plan (2007-23) to allow ten years for replacement vessel design and construction.

Active vessels that should be funded for replacement or for replacement design in the 16-year plan are shown in the table below. In addition to the three active vessels to be replaced by the funded new vessel program, an additional five vessels should be funded for replacement and four more for replacement design in the 16-year plan.

Table 23.
Vessel Replacement 16-Year Plan (2007-23)

Vessel *Replace in new vessel program	Vehicle Capacity	Year Built / Rebuilt	Current Route and Season	Retirement Range**	Funding 07-23
Steel Electric Class 1920s					
*Illahee**	59	1927 / 1986	Anacortes	2010-15	New Vessel
Klickitat	64	1927 / 1981	Keystone-all	2008-13	Replacement
Quinault	59	1927 / 1985	(maint-FWS) Keystone-Su	2010-15	Replacement
Misc. Class 1940s					
*Rhododendron**	48	1947 / 1991	Pt Defiance/Tahlequah	2011	New Vessel
1950s Evergreen State Class					
Klahowya	87	1958 / 1995	Fauntleroy/Vash/South-worth	2023-28	Replacement
Tillikum	87	1959 / 1994	Fauntleroy/Vash/South-worth	2022-27	Replacement
1960s Super Class					
Elwha	144	1967 / 1991	Anacortes-all	2025-30	Replacement
*Hyak**	144	1967 / --	(maint-all)	2010-15	New Vessel**
Kaleetan	144	1967 / 1999	Seattle/Bremerton-FWS, Anacortes-Su	2027-32	Design
Yakima	144	1967 / 2000	Anacortes-all	2028-33	Design

Vessel *Replace in new vessel program	Vehicle Capacity	Year Built / Rebuilt	Current Route and Season	Retirement Range**	Funding 07-23
1970s Jumbo Mark I Class					
Spokane	188	1972 / 2004	Edmonds/Kingston-all	2032-37	Design
Walla Walla	188	1973 / 2003	(maint-FWS) Seattle/Bremerton-Su	2031-36	Design

* WSF updated retirement plan Oct. 21, 2007.
** Assumes Hyak not rebuilt and replaced by a new vessel.

6. Emergency Repair

The 2007-09 emergency repair appropriation of $6.4 million has been substantially expended during the first three months (July 1 to Sept. 30, 2007) of the biennium due to emergency repairs to the Steel Electric class vessels that totaled $2.6 million or 41 percent of the total biennium emergency repair budget. These expenses are due to hull problems on the Steel Electric class vessels. See discussion in the section on vessel condition.

E. Consultant Observations and Recommendations

1. Implement the Provisos of ESHB 2358

Capital expenditures in the 2005-07 biennium and the 2007-23 plan both predate the adoption of ESHB 2358. The capital budget and expenditures need to be brought into compliance with ESHB 2358 to conform to the definition of what constitutes a capital expense, the requirement to separate improvements from preservation, and to implement the required improvements to the vessel life cycle cost model.

a. Definition of capital

ESHB 2358 provides that "appropriations made for the WSF capital program may not be used for maintenance costs" (Section 9 (1)). The distinction between maintenance and capital under the bill is to be established by the Office of Financial Management's (OFM) budget instructions. OFM's 2007-17 capital budget instructions define capital projects as a "project to construct either new facilities or significant, long-term renewal improvements to existing facilities" (OFM 2007-17 Capital Budget Instructions, p. 17).[6]

The costs included in the 2005-07 expenses that do not appear to conform to these definitions total approximately $1 million and include:

- ***Spare parts:*** In 2005-07 capital expenditures included $0.7 million to buy spare parts for the Issaquah class vessels built in the 1980s. The spare parts were purchased to support new equipment purchased for the periodic major maintenance in the 1999-2005 time period.
- ***Program support:*** In 2005-07 capital expenditures included $0.1 million for an Environmental Program Manager and $0.2 million for a ferry passenger partnership program.

[6] OFM is developing transportation specific budget instructions which may modify this definition.

All expenses should be reviewed to ensure conformance with ESHB 2358

b. Improvement vs. Preservation

ESHB 2358 provides that "appropriations made for preservation projects shall be spent only on preservation and only when warranted by asset condition, and shall not be spent on … non-preservation items" (Section 9 (2)).

Prior to ESHB 2358, WSF divided its capital budget into preservation and improvement projects, with all vessel expenditures in the preservation category. ESHB 2358 specifically requires WSF to define new vessel acquisitions as improvements and requires that any project that has both improvement and preservation elements be categorized as an improvement project.

The consultants note that WSF has improvement expenditures in its preservation and systemwide projects. To conform to ESHB 2358, it is recommended that WSF break out their projects between improvement and preservation, resulting in two project identification numbers (PINs) for each vessel (i.e. *Issaquah* Improvements and *Issaquah* Preservation).

The consultants note that a portion of the preservation projects are used for improvements ($0.6 million for elevators for the *Hyak* and the *Yakima).* Portions of the WSF preservation coating program is done to maintain the appearance of the vessels. These elements should be placed into an improvement budget and would include in the 2005-07 biennium expenses such as the interior painting of the *Walla-Walla.* In addition, approximately 6 percent of the 2007-09 biennium vessel preservation project budgets is for non-life cycle costs.

Seventy-five percent (75%) or $13.9 million of the $18.6 million in systemwide projects was for vessel improvements including the vessel physical security infrastructure, communication-navigation-life saving, vessel communications IT, wireless over water, vessel noise control, accessibility modifications, wireless connections, and wireless-ferry customers projects.

c. Systemwide and administrative capital program cost allocation

ESHB 2358 provides that "systemwide and administrative capital program costs shall be allocated to specific capital projects using a cost allocation plan, with systemwide and administrative program costs identifiable" (Section 9 (3)).

Of WSF's vessel systemwide expenditures in the 2005-07 biennium, $11.0 million or 59 percent were for individual vessel projects and $7.6 million or 41 percent were for system projects. To conform to ESHB 2358, WSF is proposing a cost allocation plan that once approved by OFM should be used in preparation of the 2009-11 biennium capital plan.

d. LCCM and asset management program

As discussed above, WSF is in the process of updating its vessel LCCM to conform to the requirements of ESHB 2358. A proviso in the 2007 budget bill requires WSF to review and provide a report to the Governor and the legislative Transportation Committees by January 15, 2008 on the potential development of a terminal asset management program. The consultants recommend that if the asset management program is accepted by the legislature that its extension to vessels be considered. An asset

management program that links asset renewal and maintenance strategies to customer service and agency strategic directions is important to improve vessel preservation planning.

1. Vessel Preservation Funding Recommendations

a. Improve preservation program management

The consultants believe that vessel preservation funding could be more efficiently managed by implementing the recommendations in the section on vessel condition. Reducing out of service time, implementing an integrated coating program, and conducting energy audits should more efficiently use preservation funds and potentially save money.

The consultants also recommend that WSF expend a higher percentage of the preservation budget that is provided by the legislature. This may require changes in project management to ensure that preservation funding is fully and effectively utilized while decreasing time out of service.

b. Tie vessel preservation funding to the vessel replacement plan

The recommendations in the section on vessel condition included a vessel replacement plan to be submitted to the legislature and tied to vessel funding. The LCCM should also be tied to the vessel replacement plan to ensure that vessels are fully funded for preservation until replaced.

c. Prioritize vessel preservation over vessel improvement funding

The legislature should prioritize vessel preservation over vessel improvement funding. This recommendation can be implemented when WSF provides a separate PIN for improvement projects.

d. Consider increasing preservation funding

Vessel preservation funding for existing vessels should be increased to provide full preservation for all active ships. Such increases in funding should be tied to the preservation management program improvements recommended above, and include funding for all ships planned to be active during the 16-year plan period. The consultants believe that, even with improved management, the average per biennium preservation funding of $4.5 million in the 16-year plan for the 17 vessels that are in active service during the entire 16 years is inadequate. Additionally, funding needs to be provided for any inactive vessels to be kept in the fleet and for those vessels assumed to be retired in the 2007-11 biennia (the Steel Electric class vessels and the *Rhododendron*.)

e. Do not reduce preservation funding to pay for new vessels

WSF has in the past requested, and the legislature has approved, reducing preservation funding to fund new vessels. According to WSF, a decision was made in the 2003 legislative session to use $68 million of preservation funding to help finance the construction of two new auto-passenger ferries and $9 million of preservation funding to help fund a new Keystone terminal (assumed to be at a new harbor). “The preservation funding shifted to new vessel construction came from the MV Hyak ($30 million),

various passenger only projects ($23 million), the preservation of the MV Evergreen State ($21 million) and preservation of the four Steel Electric vessels and the MV Rhododendron ($3 million)" (WSF *New Vessel Program Funding – PT/Key Route –Steel Electric Vessels – Safe Harbor Leases Where Have we Been?* Nov. 26, 2007 p. 2).

The consultants recommend that funds not be shifted from preservation to fund new vessels. As is the case with the *Hyak*, the decision to reduce funding for a vessel and retire it early to make way for a new vessel is not a cost-effective decision. The reduction in funding for the Steel Electric class vessels and the *Rhododendron* exacerbated the problems that have led to the large emergency expenditures in the 2007 fiscal year. The failure to preserve the *Evergreen State* has led to emergency funds being used when the vessel, which is normally inactive, is called into service.

Any decreases in preservation funding should not start until there is a firm delivery date for a vessel actually under construction in the shipyard. The procurement delays encountered by WSF in the new 144-car vessel program warn against premature reduction of preservation funding of vessels to be replaced.

3. Vessel Emergency Repair Funding Recommendations

The vessel emergency repair budget should not be used for planned maintenance and inspections of inactive vessels (this is done to keep vessels ready to be called out for an emergency). In the 2005-07 biennium, $0.8 million was spent from the emergency repair budget for the inactive Steel Electric class *Nisqually* and *Hiyu* on this basis, which represents 17 percent of the vessel emergency expenditures. These types of planned expenditures should be included in the vessel preservation budget.

4. Increase Vessel Replacement Funding

The 16-year plan does not provide sufficient funding for vessel replacement. Funding needs to be provided to replace the two active Steel Electric class vessels and two active Evergreen State class vessels that are not programmed for replacement by the four new 144-car vessels. Design funds need to be provided to begin replacement of the three Super Class vessels (assuming that the *Hyak* is retired early, or four if it is not) and the two Jumbo Mark I class vessels.

Funding could come from rescheduling the acquisition of the new four 144-car vessels. For example, a smaller investment in the *Hyak* would defer the replacement of that vessel.

5. Prioritize Vessel Funding over Terminal Funding

The 2007-23 16-year capital program has $267.4 million more funding for terminals than for vessels. The plan also has substantial placeholder funding for terminal improvements. The consultants recommend that vessel preservation and replacement funding be prioritized over terminal improvement funding if additional overall capital funding is not available.

6. Administrative and Design Costs

Excluding Eagle Harbor staff working on vessels and charging to capital, WSF staff charged $10 million to the vessel capital program in the 2005-07 biennium, representing 12 percent of all capital expenses. Outside design firms, primarily naval architects, charged an additional $3.8 million or 5 percent to the capital program in the 2005-07 biennium.

The consultants will make recommendations regarding these expenditures in its report on administrative expenses.

Section VI.
Maintenance & Repair Operating Finance

This section reviews the vessel biennium maintenance and repair operating expenditures for the 2005-07 biennium and budget for the 2007-09 biennium.

Important conclusions are that the vessel maintenance and repair management staffing is minimal and may need to be increased from internal realignment in order to implement the recommendations in this report. The potential for cost reductions lies in: 1) the potential implementation of the reduced out of service time and on-board service recommendations discussed in the section on capital financing; and 2) consideration of the State Auditor's recent Eagle Harbor scheduling recommendations. This section also notes that for the 2007-09 biennium the repairs budget is 14 percent lower than for the 2005-07 biennium.

A. 2005-07 Biennium Maintenance and Repair Overview

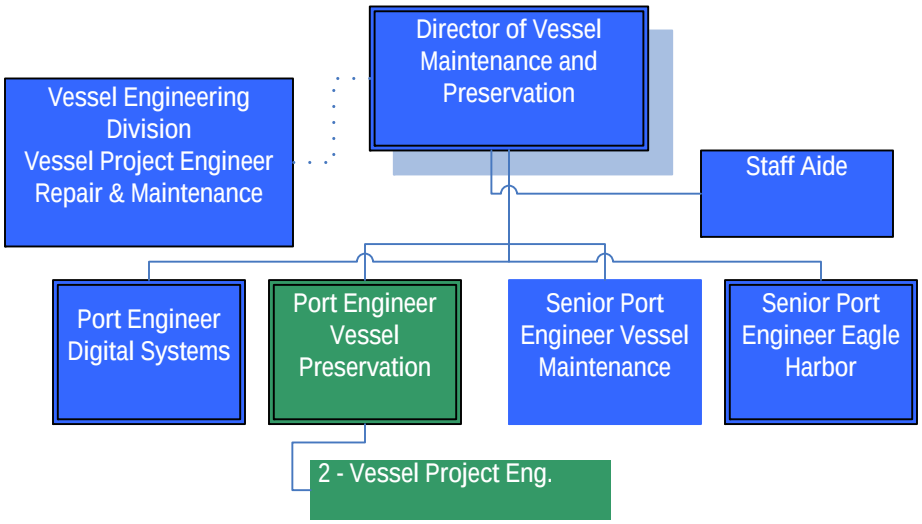
Vessel maintenance funding is provided by the Puget Sound Ferries Operations Account. For a discussion of the sources of funding for the Puget Sound Ferries Operations Account, see *Washington State Ferry Financing Study, January 2007, Appendix 5.*

Vessel maintenance is a combined effort of the vessel's engine crew, staff at the Eagle Harbor maintenance facility, and maintenance contracts performed at local shipyards.

1. Organization

Vessel maintenance and repair is the responsibility of the Director of Vessel Maintenance and Repair reporting to the Executive Director of WSF. As shown in Figure 3, the Director of Vessel Maintenance and Repair has four direct reports: a Port Engineer for Digital Systems; a Port Engineer for Vessel Preservation, a Senior Port Engineer for Fleet Maintenance, and a Senior Port Engineer for Eagle Harbor.

Figure 3.
Maintenance & Preservation Division



Key: Blue = Operating Budget Supported Green = Capital Budget Supported

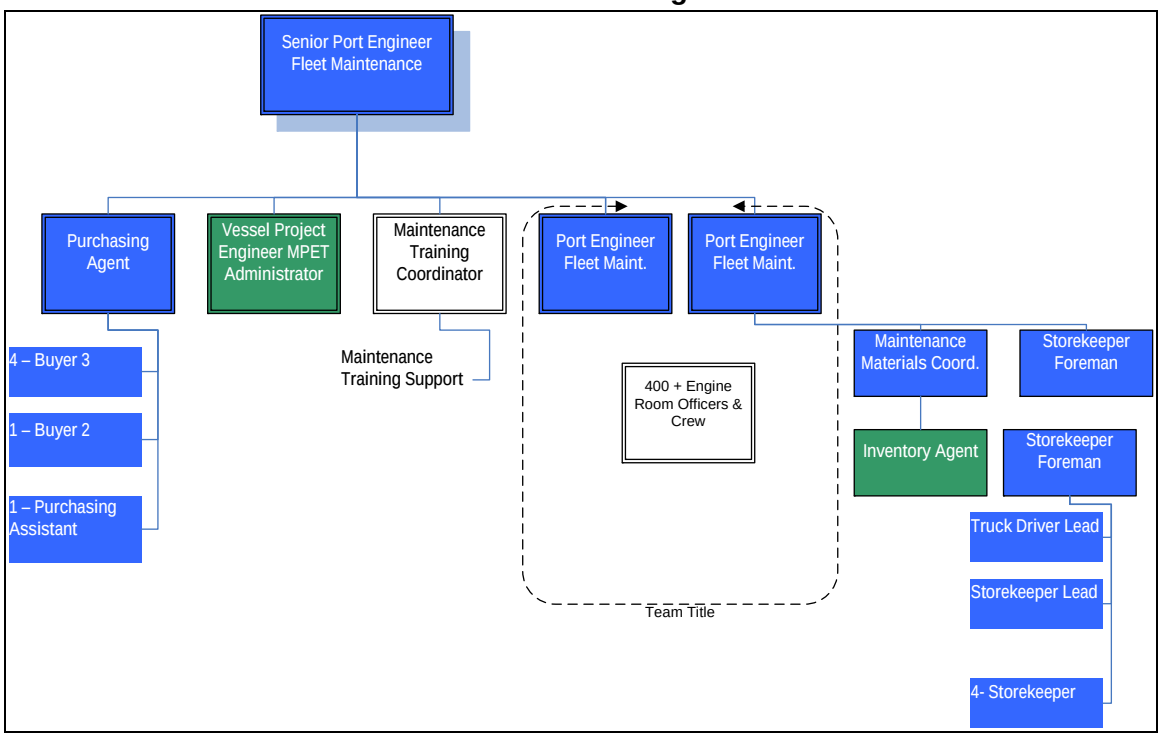
a. Vessel preservation section

The Port Engineer for Vessel Preservation and the position's two staff are in charge of the capital vessel preservation program and are responsible for managing the scope, schedule, and budget for all preservation and maintenance work done on WSF vessels in commercial shipyards. The section is supported by three Vessel Project Engineers from the Vessel Engineering Division, who are responsible for shipyard package specification creation and administering the shipyard contracts on site. All six positions are supported by the capital budget.

b. Vessel maintenance section

The Senior Port Engineer for Fleet Maintenance has five direct reports: the Purchasing Agent (with a staff of 6), a Vessel Project Engineer for MPET (Maintenance Productivity Enhancement Tool) administration, a Maintenance Training Coordinator (with a staff of 1) which is a rotating assignment from the engine room crews, and two Port Engineers for Fleet Maintenance to whom the engine room crews (staff of 400+) and the maintenance materials staff (9 positions) report. The Vessel Project Engineer for MPET is supported by the capital budget, with the other staff in the operating budget.

Figure 4.
Fleet Maintenance Section Organization Chart



Key: Blue = Operating Budget Super Green = Capital Budget Supported White – Training staff on assignment from vessel staff, in the 400+ engine room staff who are supported by the operating budget.

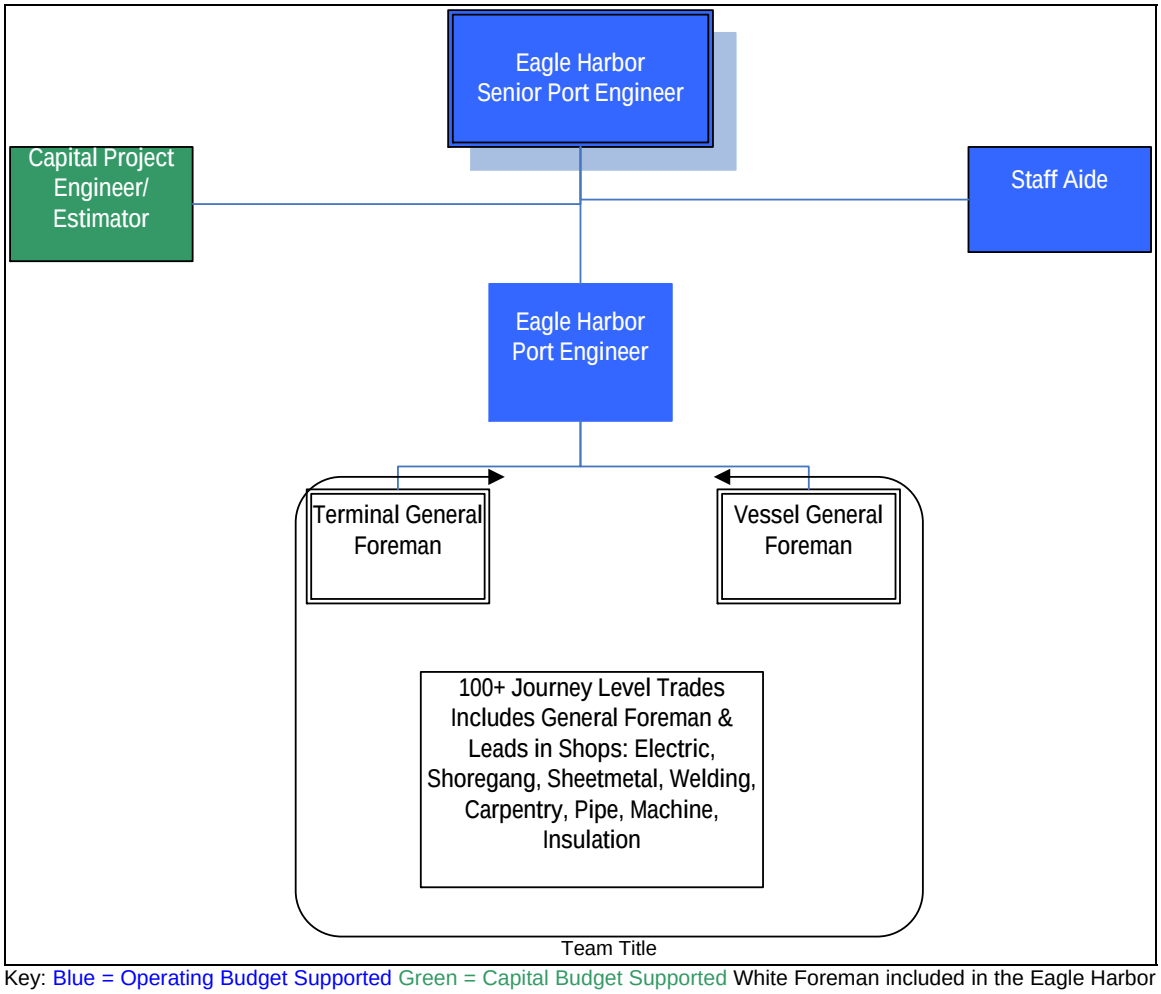
- ***MPET:*** The ferry system's Maintenance Productivity Enhancement Tool tracks vessel maintenance by transferring data from ship to shore via a wireless computer system. The tool provides information on planned maintenance

schedules, the maintenance history of each piece of machinery, and the total costs of maintenance including labor, travel time, and materials.

c. Eagle Harbor section

The Senior Port Engineer for Eagle Harbor has responsibility for both terminal and vessel maintenance at Eagle Harbor, with 5 supervisory and administrative staff and 100+ trade staff.

Figure 5.
Eagle Harbor Organization Chart



Key: Blue = Operating Budget Supported Green = Capital Budget Supported White Foreman included in the Eagle Harbor 100+ staff

Eagle Harbor was reviewed in the *2007 Washington State Ferries Performance Audit Report* by the Washington State Auditor. The Auditor recommended, among other items, that WSF consider reducing indirect and overtime charges by Eagle Harbor staff by considering re-scheduling staff to create a second shift. WSDOT's response to the *Audit* has been a commitment to review and analyze overtime and possible savings and to make recommendations as appropriate to the Governor, OFM, and the legislature by April 2008.

2. Vessel Maintenance and Repair Budget Structure

The vessel maintenance and repair budget is found in three of WSF's operating budget (Program X) subprograms:

- **X1 – Vessel Operations***:* This subprogram includes the vessel engineering room staff when the vessel is in operation. (This subprogram also includes the vessel deck crews, who are not included in this analysis.)
- **X4 – Vessel Maintenance:** This subprogram includes vessel maintenance provided at Eagle Harbor and the costs for the vessel engineering room staff when the vessel is in layover status.
- **X7- Maintenance Management and Support:** This subprogram includes the 24 positions from the Vessel Maintenance and Preservation Division shown in blue in Figures 3-5, the one position in the Vessel Engineering Division – a Vessel Project Engineer for Repair & Maintenance shown in Figure 3, and associated expenses.

B. 2005-07 Biennium Expenditures

1. Total Vessel Costs

In the 2005-07 biennium, vessel maintenance and repair expenses totaled $105.4 million out of a total vessel operating budget of $283.4 million, or 38 percent of vessel operating costs. The other major elements of the vessel budget not included in maintenance and repair expenses are fuel ($80.6 million/29 percent) and deck operations ($94.6 million/34 percent).

It should be noted that the total vessel costs include costs incurred in the 2005-07 biennium includes the costs of operating passenger-only ferry (POF) service.[7] WSF is providing a breakdown of maintenance and repair costs by ferry, which has been completed for Eagle Harbor only.

2. Maintenance and Repair Costs

As shown in the table below, of the $105.4 million in maintenance and repair costs in the 2005-07 biennium, $77.8 million or 74 percent was for labor; $19.8 million or 19 percent was for outside repair costs; $4.4 million or 4 percent was for supplies; and the remaining $3.4 million or 3 percent was for expenses including leases, utilities, communication, and other miscellaneous expenses.

The largest expenses were for the engine room crew and associated expenses in the vessel operations budget (62 percent), followed by Eagle Harbor and engine room crews during lay-up periods (31 percent), and vessel maintenance management and support (6 percent).

[7] The legislature has directed WSF to discontinue passenger-only ferry service when King County assumes operation of the one remaining POF route from Vashon to Seattle.

Table 24.
Management and Repair Costs 2005-07 Biennium
(in $ millions)

	Vessel Engine Operations	Vessel Maintenance			Maintenance Management & Support	Total	
Sub-program	X1	Eagle Harbor X4	Lay-up X4	Sub-total X4	X7		%
Labor	55.3	8.6	9.3	18.1	4.4	77.8	74%
Repairs	6.7			13.0	0.1	19.8	19%
Supplies	2.6			1.6	0.2	4.4	4%
Misc.	1.2			0.1	2.1	3.4	3%
Total	65.8	8.6	9.3	32.8	6.8	105.4	
% of Total Costs	62%	8%	9%	31%	6%		

a. Labor expenses

As shown in the table below, labor expenses of $77.8 million are a combination of direct labor costs of $75.1 million and associated travel, training, uniform, and meal allowance costs of $2.7 million.

As discussed in the *Washington State Ferries Financing Study*, January 2007 Appendix 5, WSF has little opportunity to control ship crew labor costs. The USCG sets minimum staffing requirements. Ninety-two percent of WSF employees are represented by labor unions, including licensed engine room personnel (232 in Sept. 2005), non-licensed engine room staff (166 in Sept. 2005), and Eagle Harbor shore gang and trades staff (112 in Sept. 2005). Labor agreements include requirements for overtime pay (at double time), travel pay, and penalty pay. The agreements also include minimum staffing requirements (including the requirement for one extra Assistant Engineer on Super class vessels beyond that required by the USCG) and training, uniform, and scheduling requirements.

These requirements directly affect the repair and maintenance labor costs, with 17 percent of labor costs attributable to overtime, penalty pay, and travel time pay. An additional $1.8 million was expended in the 2005-07 biennium on private automobile mileage reimbursement and $.9 million on travel, training, and providing staff uniforms.

Table 25.
Repair & Maintenance Labor Costs 2005-07 Biennium
(in $ millions)

	Vessel Engine Operations	Vessel Maintenance			Maintenance Management & Support	Total	
Sub-program	X1	Eagle Harbor X4	Lay-up X4	Sub-total X4	X7		% of labor cost
Regular work time charges	43.1	7.3	7.3	14.6	4.1	61.8	83%
Overtime	5.0	1.2	1.1	2.3	0.1	7.4	10%
Penalty time	2.0	0.1	0.5	0.6		2.6	3%

	Vessel Engine Operations	Vessel Maintenance			Maintenance Management & Support	Total	
Sub-program	X1	Eagle Harbor X4	Lay-up X4	Sub-total X4	X7		% of labor cost
Travel time	2.9		0.4	0.4		3.3	4%
Sub-total labor	53.0	8.6	9.3	17.9	4.2	75.1	
Private automobile mileage	1.8					1.8	
Travel lodging	0.2					0.2	
Employer provided meals & lodging				0.2		0.2	
Uniform clothing	0.2					0.2	
Training registration fees	0.1					0.1	
Misc. human resources expenses					0.2	0.2	
Sub-total labor related expenses	2.3			0.2	0.2	2.7	
Total	55.3	8.6	9.3	18.1	4.4	77.8	
Percentage	71%	11%	12%	23%	6%		

b. Repairs

As shown in the table below, 44 percent of the $19.8 million in repair costs in the 2005-07 biennium were for drydock related charges. These charges are in addition to expenditures on drydocking in the capital budget. Drydocking a vessel is performed in accordance with 46 CFR subchapter H regulations, i.e. twice in five years, with no more than three years apart. WSF's approach to drydockings required by the Coast Guard (called credit dry docking) is to limit the scope of work to those items that are either required by regulation or can only be done while the vessel is out of the water to limit time in drydock, which is expensive and often limited by shipyard availability.

Typical maintenance work items done during these credit drydockings are: sea valve inspection, maintenance, and repair; hull cathodic protection system inspection, maintenance, and repair; zinc renewal; rudder inspection, maintenance, and repair; propeller inspection, maintenance, and repair; inboard and outboard propeller shaft seal inspection, maintenance, and repair; void space inspection; preparation and renewal of external hull coating system above and below waterline including anti-corrosive and anti-fouling coatings, on a spot basis; removal of propeller shaft for inspection; renewal of draft marks on hull and rudders; fuel tank inspection; keel cooler inspection, maintenance, and repair; and superstructure external curtain plate coating renewal, on a spot basis.

Preservation capital drydocking includes items such as: complete external hull painting (structural preservation with a standard life cycle of eight years); hull steel replacement; rudder renewal, controllable pitch propeller replacements (for the Issaquah Class and *Rhododendron* only); piping system renewals with overboard (through hull) discharges, such as bilge piping systems, engine cooling systems, or fire main systems; and the complete renewal of superstructure external curtain plate coating, which is a portion of a complete topside paint job (structural preservation with a standard life cycle of five years).

Twenty-nine percent (29%) of expenditures were for equipment purchases, 14 percent were for payments to shipyards for repairs, 9 percent for gas and other fuel used during repairs, and the remainder for inspection fees, towing, and turbochargers.

Table 26.
Vessel Repairs Expense 2005-07 Biennium
(in $ millions)

	Vessel Engine Operations	Vessel Maintenance	Maintenance Management & Support	Total	
Sub-program	X1	X4	X7		%
Drydock		8.7		8.7	44%
Equipment purchases*	3.0	2.8		5.8	29%
Outside repairs	1.8	0.9		2.7	14%
Petroleum based products	1.7			1.7	9%
Inspection fees		0.5		0.5	3%
Towing	0.2			0.2	1%
Turbochargers		0.1		0.1	1%
Total	6.7	13.0	0.1	19.8	
%	34%	66%	1%		

*Expenses are from ES71 – which is the code for the purchase of parts and equipment directly from a vendor.

C. 2007-09 Biennium

The vessel maintenance and repair budget for the 2007-09 biennium is $111.6 million, which is $6.2 million or 6 percent higher than actual expenditures in the 2005-07 biennium. Labor remains the highest expense at 77 percent of the vessel maintenance and repair budget, with repairs at 15 percent, supplies at 4 percent, and miscellaneous expenses at 3 percent.

The increased budget is primarily attributable to recent labor agreement settlements (see *Washington State Ferry Financing Study, January 2007, Appendix 5* for further detail) The repairs budget is 14 percent lower than the 2005-07 biennium actual expenditures.

Table 27.
Vessel Maintenance & Repair Budget 2007-09 Biennium
(in $ millions)

	Vessel Engine Operations	Vessel Maintenance			Maintenance Management & Support	Total		2005-07	%
Sub-program	X1	Eagle Harbor X4	Lay-up X4	Sub-total X4	X7		%	Actual	Difference
Labor	61.3	10.3	9.4	19.9	5.0	86.2	77%	77.8	11%
Repairs	6.2			10.9		17.1	15%	19.8	-14%
Supplies	2.7			1.8	0.2	4.7	4%	4.4	7%
Misc.	0.9			0.4	2.3	3.6	3%	3.4	6%
Total	71.1	10.3	9.4	33.0	7.5	111.6		105.4	6%
	64%	9%	8%	30%	7%	100%			

D. Eagle Harbor Maintenance & Repair Expense 2005-07

Eagle Harbor staff provide maintenance support to vessels and terminals throughout the WSF system. Eagle Harbor has electrical, paint, carpentry, sheet metal, machine, pipe, welding and insulation shops that provide maintenance for vessels charged to the operating budget. These same shops also work on capital projects. The distinction is generally that when working on existing systems Eagle Harbor staff charge to maintenance and when installing or working on new systems costs are charged to capital.

1. Eagle Harbor Expenses by Vessel

In the 2005-07 biennium, Eagle Harbor total auto-passenger vessel costs were $14.1 million, of which $13.5 million or 96 percent was for maintenance and $0.6 million or 4 percent was for capital. (Eagle Harbor also spent $0.4 million on maintenance of the passenger-only ferries.)

The table below shows the total Eagle Harbor vessel maintenance costs by vessel. For active vessels, the average Eagle Harbor expense per vessel is $0.6 million for the 2005-07 biennium, ranging from a high of $0.8 million per vessel for the Jumbo Mark II class vessels to a low of $0.4 million for the *Rhododendron.*

Table 28.
Eagle Harbor Vessel Operating Expense 2005-07
(in $ millions)

	Active Vessels			Inactive Vessels	
	Exp.	%	Average/Vessel	Exp.	Average/Vessel
Steel Electric Class 1920s					
Illahee	0.6				
Klickitat	0.5				
Quinault	0.4				
Nisqually				0.3	
Sub-Total	**1.5**	**9%**	**0.5**	**0.3**	
Misc. 1940s					
Rhododendron	**0.4**	**2%**	**0.4**		
Evergreen State Class 1950s					
Evergreen State				0.1	
Klahowya	0.6				
Tillikum	0.4				
Sub-total	**1.0**	**6%**	**0.5**	**0.1**	
Super Class 1960s					
Elwha	1.0				
Hyak	1.2				
Kaleetan	0.9				
Yakima	0.7				
Sub-total	**3.8**	**23%**	**1.0**		
Misc. 1960s					
Hiyu				**0.1**	

	Active Vessels			Inactive Vessels	
	Exp.	%	Average/Vessel	Exp.	Average/Vessel
Sub-total	**3.8**	**23%**			
Jumbo Mark I Class 1970s					
Spokane	0.5				
Walla Walla	0.6				
Sub-total	**1.1**	**7%**	**0.6**		
Issaquah Class 1980s					
Cathlamet	0.4				
Chelan	0.4				
Issaquah	0.5				
Kitsap	0.5				
Kittitas	0.3				
Sealth	0.6				
Sub-total	**2.7**	**16%**	**0.5**		
Jumbo Mark II Class 1990s					
Puyallup	0.8				
Tacoma	1.2				
Wenatchee	0.5				
Sub-total	**2.5**	**15%**	**0.8**		
Total	**13.0**		**0.6**	**0.5**	**0.2**

2. Eagle Harbor Expenses by Shop

The table below shows the distribution by shop of the $13.5 million in vessel maintenance expenses incurred by Eagle Harbor in the 2005-07 biennium. The largest expenses were incurred by the machine shop (29 percent), the electrical shop (17 percent), and the pipe shop (16 percent).

Table 29.
Eagle Harbor 2005-07 Operating Expenses by Shop
(in $ millions)

Shop	Exp.	%
Machine	3.9	29%
Electrical	2.3	17%
Pipe	2.2	16%
Paint	1.6	12%
Carpentry	1.5	11%
Sheet Metal	0.8	6%
Welding	0.7	5%
Insulation	0.5	4%
Total	13.5	

E. Consultant Observations and Recommendations

1. Consider Internal Realignment to Increase Maintenance and Preservation Division Management

The consultants note that the Vessel Maintenance and Preservation Division has limited management staffing, with four staff (including the engineer in Vessel Engineering) managing the $32.9 million vessel preservation program and all repair and maintenance work done at commercial shipyards. Two managers oversee the engine room officers and crew with one also overseeing the warehouse (materials management) function. The consultants also note that the State Auditor cited the limited management staffing at Eagle Harbor as creating weakness in control and accountability of staff performance and costs.

Additional resources may be necessary to implement the bilge and void maintenance, coating, and other preservation recommendations in this report. Such staffing should come first from internal re-alignments within WSF, if possible, with additional funding added only if necessary.

2. Reduce Planned Out of Service Credit Drydockings

Consistent with the recommendations in the section on vessel condition, WSF should consider ways to reduce the amount of time spent in credit and maintenance drydockings. If the time can be reduced, it will result in substantial savings for the repair and maintenance budget.

3. Consider Implementation of State Auditor's Recommendations on Eagle Harbor Double Shifts

WSF plans to report by April 2008 on the viability of the State Auditor's recommendation on Eagle Harbor double shifts, or other ways to decrease Eagle Harbor overtime, travel, and penalty pay.

4. Review 2007-09 Biennium Repair Budget

The 2007-09 biennium repair budget is 14 percent lower than the actual expenditures incurred in the 2005-07 biennium. This should be reviewed and increased as necessary to ensure adequate repair and maintenance funding in the biennium.

Appendix A.
Hull Steel Maintenance Program Gauging Status

	Next Exam	Last Exam	Prior Exam	Comments
Steel Electric Class 1920s				
Illahee	2007	2004	1999	Gauge every drydock
Klickitat	2007	2004	2000	Gauge every drydock
Quinault	2009	2006	2004	Gauge every drydock
Misc. 1940s				
Rhododendron	2009	2006	2000	Replaced hull steel 2006. Gauge every drydock
Evergreen State Class 1950s				
Klahowya	2009	2004	1995	
Tillikum	2008	2003	1998	
Super Class 1960s				
Elwha	2009	2003	1997	
Hyak	2008	2003	1998	Replace 275 sq feet of hull steel under main engines
Kaleetan	2009	2004	1999	
Yakima	2008	2006	2000	30% on Keel approximately Frame 30 Number 2 end
Jumbo Mark I Class 1970s				
Spokane	2008	2002	1998	
Walla Walla	2009	2003	1999	Replace 110 sq feet hull steel under sewage pumps
Issaquah Class 1980s				
Cathlamet	2009	2004	1999	
Chelan	2010	2004	2000	USCG requires specific gauging at 6 years for SOLAS
Issaquah	2009	2004	1992	
Kitsap	2009	2004	1999	
Kittitas	2007	2002	1998	
Sealth	2008	2003	1998	
Jumbo Mark II Class 1990s				
Puyallup	2009	1999 (new)	N/A	
Tacoma	2008	1997 (new)	N/A	
Wenatchee	2009	1998 (new)	N/A	
*Gauging taken 10 years after major renovation or construction date, than at 5 year intervals thereafter				

Appendix B.
Preservation Days Out of Service 2006-2011 Fiscal Years

	Total Days	Start	Finish	Total Pres. Days	%
Steel Electric Class 1920s					
Quinault				29	1%
Drydock	19	3/6/06	3/24/06		
Drydock, Incline vessel	5	3/23/09	3/27/09		
Drydock	5	3/21/11	3/25/11		
Illahee				35	2%
Drydock, Incline vessel	30	5/16/07	6/14/07		
Drydock	5	2/23/09	2/27/09		
Klickitat				101	5%
Drydock	12	10/31/05	11/11/05		
Drydock, Incline vessel	30	5/16/07	6/14/07		
Security	54	10/8/07	11/30/07		
Drydock	5	4/27/09	5/1/09		
Sub-total				**165**	
Misc. 1940s					
Rhododendron				**78**	**4%**
Drydock	19	2/13/06	3/3/06		
Security, Topside paint	54	10/9/06	12/1/06		
Drydock	5	3/30/09	4/3/09		
Evergreen State Class 1950s					
Klahowya				228	10%
Topside paint	66	7/11/05	9/14/05		
Drydock, Hull paint, Co2, Seals	19	7/30/07	8/17/07		
Drydock, Generator sets, Paints, Piping	61	4/20/09	6/19/09		
Interior	82	9/28/09	12/18/09		
Tillikum				202	9%
Topside paint	68	3/20/06	5/26/06		
Drydock, paints, Piping	40	4/7/08	5/16/08		

	Total Days	Start	Finish	Total Pres. Days	%
Interior	82	1/4/10	3/26/10		
Drydock	12	6/7/10	6/18/10		
Sub-total				**430**	
Super Class 1960s					
Hyak				228	10%
Hull paint, Drydock	19	10/17/05	11/4/05		
Main Engines, Lighting, Elevator, Steel, Interior preservation	131	11/7/05	3/17/06		
Deck steel	47	10/15/07	11/30/07		
Hull steel, Drydock	19	12/3/07	12/21/07		
Drydock	12	1/31/11	2/11/11		
Kaleetan				310	14%
Piping, Topside paint	82	3/13/06	6/2/06		
Ruder, Hull paint, Drydock	19	9/18/06	10/6/06		
Steel repairs	19	4/23/07	5/11/07		
Paints, Steel, Propeller generators	75	11/24/08	2/6/09		
Drydock	12	4/13/09	4/24/09		
Piping, Topside paint	103	3/8/10	6/18/10		
Elwha				302	14%
Hull paint, Drydock, Topside paint	141	7/5/06	11/22/06		
Security control overlay	96	2/19/07	5/25/07		
Paints, Piping, Drydock	26	10/27/08	11/21/08		
Steel, Power dist, Drydock, Aux. Diesel generators	39	11/15/10	12/23/10		
Yakima				195	9%
Drydock	3	9/23/05	9/25/05		
Drydock	11	3/28/06	4/7/06		
Propeller generators	61	9/29/08	11/28/08		
Hull paint, Drydock	12	4/27/09	5/8/09		
Topside paint, Misc. paints	96	3/15/10	6/18/10		
Drydock	12	5/9/11	5/20/11		
Sub-total				**807**	
Jumbo Mark I Class 1970s					
Spokane				139	**6%**
Drydock	12	1/30/06	2/10/06		

	Total Days	Start	Finish	Total Pres. Days	%
Paint, PW tanks drydock	12	1/21/08	2/1/08		
Piping, Topside paint	103	6/28/10	10/8/10		
Drydock	12	2/14/11	2/25/11		
Walla -Walla				326	**15%**
Propulsion controls, Steering, Interior upgrade, Elevator, Security	186	3/28/05	9/29/05		
Hull and Deck Steel, Drydock and Void paint	19	3/12/07	3/30/07		
Paint curtain plate, Piping, Drydock, Steel, Paints	32	2/9/09	3/12/09		
Topside Paint	89	7/6/09	10/2/09		
Sub-total				**465**	
Issaquah Class 1980s					
Issaquah				223	10%
Hull paint, Steel, Keel cooler valves, Paint curtain plate, CPP hubs, Drydock	47 days	3/5/07	4/20/07		
Security, Topside paint	82 days	7/16/07	10/5/07		
Drydock	12 days	3/2/09	3/13/09		
Interior, Elevator, Piping	82 days	9/28/09	12/18/09		
Kittitas				148	7%
Keel cooler valves, Seals, Drydock, Security	54 days	5/21/07	7/13/07		
Paint curtain plate, Drydock	19 days	3/16/09	4/3/09		
Power dist., Elevator, Topside paint, Piping	75 days	4/6/09	6/19/09		
Kitsap				216	10%
Hull paint, Drydock, CPP hubs	61 days	11/28/05	1/27/06		
M.E Keel cooler valves, Drydock, Paints	54 days	12/8/08	1/30/09		
Elevator, Painting, Topside paint	82 days	3/29/10	6/18/10		
CPP hubs, Drydock	19 days	1/10/11	1/28/11		
Cathlamet				169	8%
Keel cooler valves, Piping, Drydock, Security	54 days	12/18/06	2/9/07		
Firemain, Sewage, Drydock	33 days	1/26/09	2/27/09		
Elevator, Piping, Propeller controls	82 days	9/27/10	12/17/10		
Chelan				172	8%
SOLAS, Drydock, Piping	26 days	1/30/06	2/24/06		
Drydock	3 days	5/8/07	5/10/07		
Gen. Keel cooler valves. M E Paints, Drydock	40 days	1/14/08	2/22/08		
Topside paint	77 days	4/7/08	6/22/08		

	Total Days	Start	Finish	Total Pres. Days	%
Temp. Power systems, Drydock, Piping	26 days	2/8/10	3/5/10		
Sealth				160	7%
Interior, Topside paint	103 days	6/12/06	9/22/06		
Drydock	5 days	5/14/07	5/18/07		
M.E., Gen. Keel cooler valves, Drydock, Steel, Piping	40 days	2/25/08	4/4/08		
Drydock	12 days	4/5/10	4/16/10		
Sub-total				**1,088**	
Jumbo Mark II Class 1990s					
Tacoma				239	11%
Drydock	12 days	1/15/07	1/26/07		
Drydock	26 days	2/12/07	3/9/07		
Piping, Steel, Paints, Security	96 days	7/9/07	10/12/07		
Drydock	13 days	1/25/09	2/6/09		
Interior, Piping, P.A. System	81 days	10/5/09	12/24/09		
Drydock	12 days	3/7/11	3/18/11		
Wenatchee				243	11%
Drydock	19 days	1/9/06	1/27/06		
Drydock	19 days	2/18/08	3/7/08		
Paints, Piping, Security, Steel	103 days	3/10/08	6/20/08		
Interior, Piping, P.A. System	102 days	10/12/10	1/21/11		
Puyallup				216	10%
Drydock	12 days	10/23/06	11/3/06		
Paints, Piping, Security	103 days	6/23/08	10/3/08		
Drydock	19 days	10/6/08	10/24/08		
Interior, piping, P.A. system	82 days	1/18/10	4/9/10		
Sub-total				**698**	
Total				**3,731**	

*Work began in FY 2005

Appendix C.
144-car Vessel Procurement Process

Existing design-build authorization: In 2001 after receipt of the Office of Financial Management's *Performance Audit of the Washington State Ferry System Capital Program,* the legislature authorized a design-build approach to auto-ferry construction. The contractor is to be selected in a three-phase request for proposal (RFP) process.

- ***Phase one*** is to evaluate and select pre-qualified proposers to participate in subsequent development of technical proposals. The Washington State Department of Transportation (WSDOT) is to evaluate submitted proposals in phase one under selection criteria that may include but are not limited to: shipyard facilities, organization components, design capability, build strategy, experience and past performance, ability to meet vessel delivery dates, projected workload, and expertise of project team and other key personnel.
- ***Phase two*** involves preparation of technical proposals by those firms qualified in phase one. The technical proposals must include: design and specification sufficient to fully depict the ferries' characteristics and identify installed equipment; drawings showing arrangements of equipment and details necessary for the proposer to develop a firm, fixed price bid; and project schedule including vessel delivery dates.
- ***Phase three*** consists of the submittal and evaluation of bids, and the award of the contract for the final design and construction of the auto ferries. The bids must be in conformance with the approved technical proposal. WSDOT is to select the responsive and responsible proposer that has submitted the lowest total bid price. WSDOT may provide an honorarium to reimburse each unsuccessful phase three proposer for a portion of its technical proposal preparation costs at a pre-set, fixed amount to be specified in the request for proposals (RCWs 47.60.810 - 47.60.822).

New 144-car vessel procurement design-build process experience: The current 144-car vessel procurement process is the first under RCWs 47.60.810 - 47.60.822.

- ***Phase one:*** The first phase of the new vessel construction program began in December 2003, when WSF began the process of determining which Washington shipyards are technically and financially qualified to submit bids. State law requires that WSF's vessels be built in Washington, although propulsion systems and diesel generators may be built elsewhere. Three shipyards were qualified (WSF New Vessel Program Fall 2006 Report, p.1).
- ***Phase two:*** WSF started the second phase of the project in August 2006, issuing a RFP for design and construction of the ferries to the qualified shipyards (WSF New Vessel Program Fall 2006 Report, p.1).

Due to problems encountered during Phase II of the procurement process, the legislature adopted ESHB 2378 in the 2007 legislative session. This bill modified the vessel design build laws to allow WSDOT to accept a single proposal submitted jointly by the current best-qualified proposers (three shipyards qualified in Phase I of the procurement) for the

144-car new vessel procurement. The bill authorized WSDOT to negotiate a fair-value contract with the joint proposer (or single proposer if only one). The fair-value contract may consider the scope as well as contract price. The contract price must be established through negotiation based on detailed cost and price information provided by the proposer, WSDOT, and other relevant sources in a format as determined by WSDOT. To achieve efficiencies, WSDOT may negotiate incentives and economic cost sharing between the state and the proposer. Other incentives may be considered, as determined by WSDOT, to be in the best interests of the state. Such incentives may include, but are not limited to, key schedule milestones, technological innovations, performance efficiencies, constructability, and operational value or life-cycle cost. WSDOT may issue guidelines, requirements, and procedures for all negotiations. If WSDOT conducts negotiations with a single remaining proposer or joint proposers prior to the submission of bids in Phase three, all negotiations must be completed within 45 days of WSDOT's approval of the final technical proposal. If WSDOT conducts negotiations with a single responsive and responsible Phase III bidder, all negotiations must be completed within 30 days of submission of the Phase III bids.

WSDOT may issue a new request for proposals or cancel the request for proposals process under the following circumstances: If WSDOT is unable within the designated time period to reach an agreement with the proposer or joint proposers that is fair, reasonable, and within budget; if the proposers initially provide notice of their intent to jointly submit a single proposal but fail to do so; if any one of the proposers withdraws from a jointly submitted single proposal before entering into a contract with WSDOT; or if both of the current best-qualified proposers withdraw or otherwise fail to proceed with the request for proposals process.

In June 2007, the three shipyards submitted a joint proposal to build the new vessels, with a contract to be signed in November 2007 for the commencement of Phase II of the procurement process.

Appendix D.
Vessel Funding by Class and Vessel

1. Steel Electric/Rhododendron – Built 1920s and 1940s

The Steel Electric class vessels and the *Rhododendron* received 7 percent of the total vessel funding in the 2005-07 biennium. As discussed in the section on vessel condition, these vessels in the 2007-09 biennium are experiencing significant steel deterioration problems and are in urgent need of replacement.

- ***Rhododendron:*** The $0.5 million in preservation expenditures was for structural preservation and steel replacement and included $0.1 million in preliminary engineering expenses. The $0.7 million in systemwide expenditures was for physical security infrastructure improvements ($0.5 million) and communication information technology ($0.2 million).
- ***Illahee:*** The $0.4 million in preservation expenditures was for structural preservation while the *Illahee* was in drydock.
- ***Klickitat:*** The $0.2 million in preservation funding was for drydocking. The $0.2 million in systemwide project expenditures was for maintenance work being reimbursed by the operating budget under the Vessel Contract Using CAPS project (see below for further explanation). The $0.2 million emergency repair was for dockside emergency repairs including emergency drydocking, vendor repairs, Eagle Harbor labor expenses, and towing.
- ***Nisqually:*** The Nisqually is an inactive, de-crewed vessel. In the 2005-07 biennium $0.1 million was spent on dockside preservation activities and $0.3 million on emergency repairs for regulatory compliance and the installation of Sub-Chapter W (federal life safety requirements) lifesaving equipment. These expenditures were necessary for the Nisqually to be placed into emergency active service.

2. Evergreen State Class Vessels – Built 1950s

The Evergreen State class vessels received 7 percent of the vessel capital funding in the 2005-07 biennium.

- ***Evergreen State:*** The Evergreen State is a de-crewed, inactive vessel. Only $21,000 in capital funds were spent on this vessel in the 2005-07 biennium.
- ***Klahowya:*** The $0.9 million in preservation funding was for dockside structural preservation and included $0.2 million in maintenance project management and preliminary engineering expenses. The $0.6 million for systemwide projects included: $0.4 million in physical security infrastructure expenditures; $0.1 million in communication-navigation-life saving improvements; and $0.1 million in a combination of vessel noise control, fuel monitoring, and vessel communications information technology expenditures.
- ***Tillikum:*** The $0.9 million in preservation was for dockside preservation and included $0.1 million in maintenance project management and preliminary engineering expenses. The $0.7 million in systemwide projects included $0.5

million in physical security infrastructure expenditures and $0.2 million in vessel communication information technology improvements.

3. Super class vessels – built 1960s

The Super class vessels received 49 percent of the vessel capital funding in the 2005-07 biennium. As discussed in the section on vessel condition, these vessels were re-built in the 1991-2000 time period with the exception of the *Hyak*, which was not rebuilt and which WSF plans to retire in 2010-15.

- ***Elwha***: The $6.2 million in preservation expenses included: $1.3 million for propulsion control system replacement; $2.9 million for piping, steel replacement, and structural replacement while the *Elwha* was drydocked; $1.5 million in dockside expenses for a new communications public address system and steel replacement; and $0.5 million in preliminary engineering expenses. The $1.4 million in systemwide project expenses included: $0.8 million for physical security infrastructure improvements; $0.3 million for vessel communications information technology; $0.2 million for maintenance projects that were reimbursed from the operating budget under the Vessel Contracts Using CAPS project (see discussion below for further explanation of this project); and $0.1 million for accessibility modifications. The emergency repairs to the *Elwha*, which at $2.1 million were 45 percent of vessel emergency repairs in the 2005-07 biennium, were from April 2006 when the vessel experienced a drive motor casualty, damaging the armature and causing damage to the commutator.
- ***Hyak:*** The *Hyak,* which WSF plans for retirement in 2010-15, received $6.5 million in preservation work in the 2005-07 biennium including: $4.5 million for the addition of passenger elevators, structural preservation to the hull and interior, decking repairs, and asbestos removal; $1.8 million for the installation of four refurbished engines and replacement of the generators; and $0.2 million in preliminary engineering and project management costs. The $0.9 million in systemwide project expenses included: $0.5 million for physical security infrastructure improvements; $0.1 million for communication-navigation-life saving improvements; $0.1 million for vessel communications information technology improvements; and $0.2 million for accessibility improvements.
- ***Kaleetan:*** The $2.8 million in preservation expenses included: $1.6 million in dockside preservation for piping, propulsion controls, interior preservation, and structural preservation; $0.8 million in propulsion generator procurement and new switchboards; $0.3 million in preliminary engineering and project management expenses; and $0.1 million for elevator work. The $0.6 million in systemwide project expenses included $0.3 million for navigation equipment; $0.1 million for fuel monitoring equipment; $0.1 million for accessibility modifications; and $0.1 million for a combination of physical security infrastructure and reimbursable maintenance projects. The $0.1 million for emergency repairs was for steel repairs.
- ***Yakima:*** The $0.4 million in preservation expenses included $0.1 million for elevator procurement and $0.3 for a new switchboard. The $0.1 million emergency repair was for an emergency drydocking.

4. Jumbo Mark 1 class vessels – built 1970s

The two Jumbo Mark 1 class vessels received 17 percent of the vessel capital funding in the 2005-07 biennium. Of the $7.4 million expended on this class, $7.1 million was for the *Walla Walla*.

- ***Spokane:*** The $0.2 million in preservation expenses was for the propulsion control system. The $0.1 million in systemwide project expenses was primarily for equipment procurement and for the purchase and installation of radar and navigation equipment.
- ***Walla Walla:*** The $6.4 million in preservation expenses included: $3.4 million for interior preservation; $1.2 million for major mechanical work; $0.9 million for new propulsion systems; $0.1 million for structural preservation; $0.5 million for steel replacement; and $0.3 million in preliminary engineering costs. The $0.7 million for systemwide project expenses included $0.6 million for physical security infrastructure improvements and $0.1 million in a combination of expenses for a new data logger and accessibility, navigation, and communication information technology improvements.

5. Issaquah class vessels – built 1980s

The Issaquah class vessels received 29 percent of all vessel capital expenditures in the 2005-07 biennium. Of the $12.4 million in expenditures on this class of vessel, $5.7 million or 46 percent was for the *Sealth.* As discussed in the section on vessel condition, the Issaquah class vessels are not scheduled to be rebuilt but are to receive on-going major maintenance.

- ***Cathlamet:*** The $0.2 million in preservation expenses was for major mechanical work and included $0.1 million in preliminary engineering expenses. The $1.2 million in systemwide project expenses included: $0.5 million for physical security infrastructure projects; $0.2 million for communications information technology improvements; $0.2 million for vessel noise control; $0.1 million for navigation improvements; $0.1 million for fuel monitoring equipment; and $0.1 million for spare equipment. The $0.2 million for emergency repairs was for regulatory work and an emergency dockside repair.
- ***Chelan:*** The $0.3 million in preservation expenses included $0.1 million in drydocking expenses; $0.1 million for SOLAS (Safety of Life at Sea) modifications to meet requirements for navigating in international waters, required for vessels on the Anacortes-Sydney route); and $0.1 million in preliminary engineering expenses. The $0.2 million in systemwide projects included $0.1 in vessel projects for propulsion control and $0.1 million for propeller shaft seals.
- ***Issaquah:*** The $1 million in preservation expenses included: $0.7 million for structural preservation and major mechanical work while the *Issaquah* was drydocked; and $0.3 million in maintenance project management and preliminary engineering. The $0.4 million in systemwide project expenses included $0.2 million for the procurement of spare parts; $0.1 million in noise control improvements; and $0.1 million in a variety of physical security installation and

navigation equipment projects. The $0.2 million in emergency repairs was for an emergency drydocking and repair of the reduction gears.

- ***Kitsap:*** The $0.7 million in preservation expenses included $0.5 million in structural preservation during drydocking and $0.2 million in preliminary engineering expenses. The $1.2 million in systemwide project expenditures included: $0.7 million for physical security infrastructure improvements; $0.2 million for spare equipment procurement; $0.1 million for navigation improvements; $0.1 million for vessel communication information technology; and $0.1 million for a combination of maintenance projects that were reimbursed from the operating budget under the Vessel Contracts Using CAPS project (see discussion below for further explanation of this project) and noise control projects.
- ***Kittitas:*** The $0.2 million in preservation expenses included $0.1 million for structural preservation and piping replacement when the *Kittitas* was in drydock and $0.1 million in preliminary engineering costs. The $0.8 million in systemwide project expenses included $0.3 million for physical security improvements; $0.2 million for spare equipment procurement; $0.2 million for vessel communications information technology improvements; and $0.1 million for noise control.
- ***Sealth:*** The $4.6 million in preservation expenses included: $3.1 million for interior preservation; $1 million for structural preservation; and $0.5 million for preliminary engineering and maintenance project management. The $0.9 million in systemwide project expenses included: $0.5 million for physical security improvements; $0.3 million for vessel communications information technology; and $0.1 million for spare parts equipment procurement. The $0.2 million in emergency repairs was for regulatory compliance and emergency drydocking.

6. Jumbo Mark II class vessels – built 1990s

The three Jumbo Mark II class vessels received 3 percent of the vessel capital expense budget in the 2005-07 biennium. Fifty percent (50%) of the $1.4 million spent on this class of vessels was for a $0.7 million emergency repair to the *Tacoma*.

- ***Puyallup:*** The $0.1 million in systemwide project expenses was for physical security infrastructure improvements and navigation equipment.
- ***Tacoma:*** The $0.4 million in preservation expenses was for structural preservation while the *Tacoma* was drydocked. The $0.7 million in emergency repairs was for two emergency dockside repairs.
- ***Wenatchee:*** The $0.2 million in systemwide project expenses included $0.1 million for navigation equipment and $0.1 million for physical security infrastructure.

7. Hiyu

The *Hiyu*, which is a de-crewed, inactive vessel, received $0.4 million in Emergency Repair funding in the 2005-07 biennium, which was used for its mandatory annual sea trial and the installation of Sub-chapter W (federal life safety required) lifesaving equipment.