Environmental Initiatives at Seaports Worldwide:

A Snapshot of Best Practices

Final

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EXECUTIVE SUMMARY

In the summer and fall of 2009, the Port of Portland conducted a project to research environmental initiatives being implemented at seaports around the world. The objective of the research was to provide internal and external stakeholders with a greater awareness and understanding of how seaports are managing natural resources, adopting new operating methods, and planning for sustainability. The research was also conducted to provide a better understanding of the geographic, community, financial, and regulatory context that led to the decisions that seaports made when implementing these new practices.

Additionally, the research will be used by the Port of Portland to manage its seaport environmental operations and to inform its decision-making processes on future development. To help achieve this objective, the Port of Portland partnered with the International Institute for Sustainable Seaports (I2S2) to conduct research, draw from collective knowledge, and to report on the sustainable practices in the international seaport community. I2S2 collaborated on this effort with Port of Portland staff, who conducted research and reported on North American (N.A.) seaports. The information collected by the Port of Portland and I2S2 has been combined into this White Paper.

For this project, I2S2 and Port of Portland staff performed data research and conducted interviews to provide a basis for examining the current state of environmental initiatives and best operating practices in the seaport community. Researchers utilized a questionnaire jointly developed by I2S2 and the Port of Portland that addressed a range of issues related to sustainable port operations and the environment. The questionnaire was the template for Internet research and for interviews with appropriate and available personnel and included the following environmental areas:

- Air Quality
- Climate Change
- Water Quality
- Waste Minimization
- Dredging
- Energy Conservation and Renewable Energy
- Natural Resources
- Sustainability
- Environmental Management Systems

This White Paper represents a snapshot of current environmental initiatives in use at seaports around the world during the summer and fall of 2009. The results of the research demonstrate that international seaports are dealing with many of the same challenges as N.A. seaports, and the majority of sustainability practices and initiatives being applied at international seaports have been or are being employed at N.A. seaports. Consequentially, the research provided no substantive indication of innovative best practices used at international seaports that have yet to be implemented at N.A. seaports (barring practices that are culturally or geographically particular to a region). That is, many of the stakeholder engagement processes, mitigation projects, water conservation strategies, environmental management systems, and renewable

energy technologies currently implemented at international seaports are also being implemented at N.A. seaports. This shows that many of the sustainable practices currently used by seaports are universal, have broad application, and have been successful in multiple locations throughout the world.

The research also showed that seaports have created associations, collaborations, and partnerships to provide the information and tools necessary to support environmental management and sustainability efforts. Much of the information and tools in use at international seaports were developed through the International Association of Ports and Harbors (IAPH), EcoPorts, and the European Seaports Organization (ESPO). Similar associations, collaborations, and partnerships have occurred in the United States under initiatives led by the American Association of Port Authorities (AAPA), the U.S. Environmental Protection Agency (USEPA), and through smaller, regional organizations such as Puget Sound Partnership. As a result, a number of environmentally beneficial approaches are being implemented in each of the areas researched.

A major finding from the research was that each seaport – no matter where it is located – has a unique set of geographic, political, community, operational, and financial circumstances that shape and define its environmental initiatives. Therefore, each seaport has taken a slightly different approach to environmental initiatives, based on their unique circumstances. Examples of such differences include the unique local regulatory requirements (special air emissions or stormwater regulations); the lines of business (auto, cruise, container, break-bulk, bulk, etc.); management (i.e., landlord port, facility operator, or a combination); the type of operations that are managed (i.e. marine terminals, airports, real estate and industrial developments, tunnels, bridges and ferries, etc.); and, geography of the seaport on a freshwater river system, estuary, or saltwater harbor (this determines what environmental conditions are encountered and how they are handled).

These factors are important for considering and evaluating potential applications of processes, approaches, and technologies described in this paper, and for anyone reviewing programs that a particular seaport has taken to minimize environmental impacts.

Highlights of the research are included below and discussed in more detail in the body of the paper.

Air Quality

Globally, seaports are utilizing a combination of approaches to reduce air emissions and improve air quality. The means of achieving these goals are varied and rely on many factors, including the regulations governing a seaport (international standards; state and local regulations); size and financial capabilities; the operations and business lines; and the partnering opportunities available with tenants, regulators, and technology developers.

For example, when larger, high-volume seaports upgrade or build new terminals, the opportunity to replace existing cargo handling equipment with cleaner, more efficient models is common, as is repowering larger equipment to save energy and reduce emissions. Smaller, lower volume

seaports have few, if any, opportunities to build new terminals. Therefore, the small-volume seaports have a tendency to retrofit older equipment with emission controls devices and implement process improvements, such as idle reduction procedures.

In addition, many North American and international seaports have considered alternative fuels for their equipment and motor fleets, such as all electric, electric hybrid, natural gas, propane, and ultra low sulfur diesel and biodiesel.

Shore power (cold-ironing) for commercial cargo vessels is currently limited to the Southern California seaports of Long Beach and Los Angeles and to a roll/on roll/off (ro/ro) terminal in Gothenburg, Sweden. Several other seaports (e.g. New York/New Jersey) have shore power at cruise terminals where a partnership has been developed between the cruise line and the port. At the Port of Rotterdam, shore power is being used on vessels that the Port of Rotterdam owns and operates, thereby putting the full financial liability on the Port of Rotterdam. Shore power requires a major financial investment and coordination by the vessel owner to retrofit vessels, by the terminal operator to manage each vessel call, and by the seaport to provide the shore-side infrastructure. Because of this, there is slow implementation of shore power at seaports worldwide.

Climate Change

A number of international seaports have signed on as members of the World Ports Climate Initiative (WPCI) to manage climate change and greenhouse gases (GHGs). Members of the WPCI are actively working on a variety of projects which target climate change issues. These projects include developing guidance for measurement of a seaport complex carbon footprint; guidance to improve intermodal transport; "green" lease templates; and innovative cargo handling equipment pilot projects. Members of the WPCI are also developing an environmental ship index (ESI) to measure the air quality impacts of vessels as part of a shore power decision toolkit.

Additionally, several seaports published that they were conducting greenhouse gas assessments, retrofitting older diesel powered equipment with cleaner burning fuels or hybrids, and implementing fuel reduction technologies. Of those seaports reviewed, several are members of the WPCI and are making significant commitments to address global warming. For example, the Port of Rotterdam is striving to achieve a 50 percent reduction in CO_2 by 2025, compared to its1990 baseline. In 2008, the Port of Auckland became one of the first seaports in Australasia (New Zealand, Austrailia, New Guinea) to measure and audit its GHG emissions and carbon footprint. The Port's inventory of total greenhouse gas emissions was audited by PricewaterhouseCoopers.

Water Quality

Worldwide, the discharge limits on stormwater runoff from facilities are becoming more stringent. As a way to address increased regulation of runoff to water bodies, seaports are looking to infiltrate stormwater into the ground through the use of bioswales, infiltration basins,

drywells, and pervious pavement. For N.A. seaports, USEPA regulations have attempted to standardize the approach for regulating stormwater runoff; however, state, regional, and local regulations often contain additional requirements. Water conservation programs at the seaports researched appear to be centered on addressing landscaping irrigation issues and using water restriction devices in buildings.

Waste Minimization

Several seaports indicated that municipal ordinances drive their programs to achieve various levels of recovery of recycled materials, and the majority of seaports researched have well-established recycling programs. Many of the seaports interviewed have their own in-house programs and also participate with local community agencies to maximize their recycling efforts. Several seaports include reduce-recycle-reuse policies as part of an Environmental Management System (EMS) and sustainability program. Waste minimization and recycling programs include measurable goals, objectives, monitoring requirements, and reporting schedules to track progress and to identify areas of improvement.

Recycling of construction material is a universally accepted practice. Construction and demolition projects, generally large in scale, provide excellent opportunities for cost effective recovery of large quantities of construction debris including metal, wood, concrete, and asphalt.

A number of seaports indicated that over the last year, recycling programs that were once break-even or slightly profitable have become money-losing operations due to the downturn in the economy and subsequent drop in value of the recycled commodities. While most seaports plan to continue with their programs, decisions to drop specific commodities that are recycled may have to be made.

Dredging

Water quality and endangered species concerns often dictate the way dredging projects are conducted. Several of the seaports researched noted that biological testing for sediments is becoming a very common requirement. Options employed for placement of dredge material include shallow water habitat creation, fill material for upland projects, submerged storage sites, ocean disposal, cover for landfills, and caps for brownfield sites. Several seaports utilize innovative technologies to suspend sediments in order to minimize dredging.

Both upland and confined disposal sites are used for contaminated dredge material. Several seaports are partnering with local companies and universities to find solutions for contaminated dredge materials. For example, the Maritime and Port Authority of Singapore (MPA) partnered with a local technology company to develop an award winning technology to safely treat contaminated dredged materials and industrial waste, and convert them into environmentally safe construction and reclamation materials. This reduces or eliminates disposal and potential pollution issues arising from dredging and disposal of maritime related wastes such as oil sludge and copper slag.

Energy Conservation & Renewable Energy

A number of seaports worldwide rely on the ability to purchase "green power" or renewable energy credits (RECs) from their energy providers in order to address renewable energy goals. This approach was most common on the U.S. West Coast, with several seaports having specific goals for the purchase of renewable energy. Others have heavily invested in renewable energy as part of new development projects or in partnership with their host cities. Also within the US, cruise terminals appear to be a popular choice for the installation of solar equipment as most are located in warm, sunny, temperate zones

The installation of renewable energy sources such as solar or wind power generation equipment on port facilities isoften in partnership with tenants and electricity providers. These partnerships benefit the local communities as well as the seaports themselves. For example, residual heat from companies in the Rotterdam port complex is used to provide heating and cooling to houses, hospitals, and businesses around the city. Energy is produced for local communities through large wind turbines on seaports located in Europe and Japan.

Natural Resources

By virtue of the nature of their business, seaports are located in some of the most environmentally sensitive areas. Wetland and shoreline concerns are a universal issue encountered in both day-to-day operations and during project development and construction. Salt water, estuary, and freshwater port locations present different challenges that prevent the use of a "one size fits all" solution to manage these unique environments. Several seaports interviewed have dedicated staff to manage mitigation and shoreline protection programs, while the remaining seaports handle mitigation issues on a case by case or project by project basis. Additionally, a majority of seaports considered many of their natural resource management activities as community benefit programs.

A common approach for both U.S. and international seaports is to partner with local municipalities, state agencies, nature conservancies, and community groups for completing mitigation projects, either on port-owned properties or at off-site locations. Some seaports prefer to provide financial support for off-site mitigation banks that are developed by third parties.

Several seaports have successfully established mitigation banks of their own by creating or enhancing natural resource lands both on and off of their properties prior to the need for the mitigation. The establishment of mitigation banks allows minimization of natural resource mitigation delays to development by providing pre-approved and constructed habitats.

In some cases, regulatory requirements concerning development and natural resource protection extend beyond a state or country's boundaries. International laws governing the protection of certain animal species and migratory birds require coordination beyond local or in-country authorities. For example, the Port of Brisbane's Moreton Bay is recognized as a wetland of international significance. Many of the shorebirds that visit the mudflats there are migratory species protected by the Japan Australia Migratory Bird Agreement (JAMBA) and the China

Australia Migratory Bird Agreement (CAMBA). In recognition of the significance the Port's reclamation areas play in providing high-tide roost habitat, it created the largest constructed shorebird roost in eastern Australia, which provides for both conservation and education management of shorebirds.

Sustainability

There are ranging viewpoints on what a particular seaport considers as a definition of sustainability. Many international seaports, especially those in the European Union (EU), subscribe to a reporting scheme known as Corporate Social Responsibility (CSR). Within this accounting, metrics that involve community integrity in addition to economic vitality and environmental stewardship are included. There is no standard definition for "sustainability" within the port industry; therefore, the research found that there was a wide range of considerations – from CSR reporting to embracing the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, as the sole reference to sustainability.

There is considerable reliance on LEED by almost all of the U.S. seaports contacted or researched as the main source of guidance in building development or renovation. Many seaports have policies in place that dictate any new construction attains a certain LEED certification level. Additionally, many states, cities, and municipalities have regulations or ordinances that require publicly owned buildings to be built in accordance with LEED criteria. There is no universal standard for building and design within the EU; however, similar components of the LEED guidelines are being applied at a number of EU seaports.

Several seaports have developed their own development standards and guidance manuals for design and construction of new and redeveloped facilities, while others use life cycle costs and sustainability scorecards to review new development projects. These standards and guidance incorporate such elements as Low Impact Development (LID) standards as well as LEED requirements.

Environmental Management Systems (EMS)

There is significant implementation of environmental management systems (EMS) or a facsimile thereof at seaports worldwide. The majority of seaports that utilize EMS limit the systems to specific properties, operations, or programs. This approach is commonly referred to as a "fence line EMS."

With the advent of the International Standards Organization (ISO) and the promulgation of ISO 9000 and ISO 14001, international ports were early adopters of a systematic approach to port operations and development. Many of the ports reviewed had ISO 14001 certification and are members of the EcoPorts Foundation (EPF), a non-profit organization established in 1999 by a group of eight large European seaports for the benefit of ports and port communities. Through EcoPorts, member seaports can obtain a certification in proactive environmental management called the Port Environmental Review System (PERS). PERS defines a basic standard of good practice for the seaport sector. Several seaports were also certified by the European Union's Eco-Management and Audit Scheme (EMAS). This is a voluntary instrument which acknowledges

organizations that improve their environmental performance on a continuous basis. EMAS differs from ISO14001 by its government-legal origin.

While EMS implementation is becoming more common at seaports in the U.S., full ISO 14001 certification can be a time consuming and costly endeavor that only a few seaports have completed. However, many have "self-declared" (i.e. self monitored) and continue to find great benefit in improved operational efficiencies, improved environmental compliance and stewardship, and cost savings. In the U.S., the American Association of Port Authorities has sponsored an EMS program for over 25 port authorities to help realize these benefits.

BACKGROUND and INTRODUCTION

The marine shipping industry has dramatically changed over past century. Vessels and ports have become larger, cargo handling methods have become more efficient, and the number of ports and shipping companies has been reduced. This change in the shipping industry, which serves the increasing globalization of trade and production that has improved the standard of living for millions of people worldwide, has resulted in increasing impacts to the local community and the local environment. Over the last several decades, the marine shipping industry, like many industries, is integrating practices into its operations that reduce costs and impacts to the environment, while improving social responsibility and strengthening its economic position.

To develop a more thorough understanding of sustainable seaport operations and development practices worldwide, the International Institute for Sustainable Seaports (I2S2) was contracted by the Port of Portland to conduct research, draw from collective knowledge, and provide a summary of environmental management practices in the international seaport community. At the same time, the Port of Portland conducted a similar review of practices at North America (N.A.) seaports. The research focused on those activities that influence, affect, or are in response to environmental management and sustainable development.

The resulting information collected in this report is intended to help increase the knowledge of seaport planning and operations to inform the Port of Portland's decision-making processes regarding current operations and future development. Further, it presents background on and provides context for the practices that seaports have used to decrease environmental and community impacts despite operating in resource-intensive industries.

The research has found that most initiatives cannot simply be copied: geography, environmental conditions, and politics drive the types of projects and programs that are implemented. However, a catalogue of current best practices, which provides a fuller understanding of the trends, opportunities and constraints of various initiatives at seaports worldwide, can be used to adjust the operations of existing facilities and to plan for future facilities.

APPROACH

I2S2 conducted interviews with a variety of international seaports, and the Port of Portland conducted interviews with North American (N.A.) seaports. The objective was to compile information about environmental initiatives at seaports worldwide. The data was gathered from interviews, web research, and other publicly available reports. I2S2 limited its review to current members of the International Association of Ports and Harbors (IAPH).

The interviews focused on strategies related to community and environmental management and the unique environmental concerns faced by seaports. The interviews and related research were not intended to be exhaustive or to serve as a review of environmental compliance. Instead, the goal was to establish a snapshot of environmental initiatives that are currently being used at the seaports that participated in the survey.

Interviews were conducted utilizing a questionnaire (Appendix A) developed jointly by I2S2 and the Port of Portland. It addressed several key environmental programs areas related to seaports:

- Air Quality
- Climate Change
- Water Quality
- Waste Minimization
- Dredging
- Energy Conservation and Renewable Energy
- Natural Resources
- Sustainability
- Environmental Management Systems

A list of the ports that were considered as part of this review is found in Appendix D.

THE STATE OF THE INDUSTRY: PORT SUSTAINABILITY

Research conducted for this report found that seaports around the world are demonstrating a commitment to environmental stewardship and sustainable port operations through a variety of actions, mandates, and initiatives. These actions are influenced by issues like climate change, the global economic downturn, and evolving environmental regulations. Seaports are also motivated to undertake new programs that improve economic viability, improve community and regulatory relations, and reduce impacts to the environment.

Compliance with environmental regulations has been the traditional driver for seaports to incorporate environmental considerations into their activities and plans. Beyond environmental compliance, however, the research found that corporate social responsibility (CSR) was a prominent goal outlined in the charters of many seaports. These seaports expressed commitment to incorporating community and stakeholder concerns into the financial and environmental goals of their organizations. Several seaports publish annual CSR reports quantifying their sustainability activities related to operations and development. Other activities cited include frequent and formal stakeholder engagement to ensure that communities and regulators are included in decision-making processes; implementing an Environmental Management System (EMS) throughout the entire development and operation processes; and mitigation efforts designed to meet regulatory requirements while also providing long-term community benefits.

Relative to managing climate change and greenhouse gases (GHGs), a number of international seaports have signed on as members of the World Ports Climate Initiative (WPCI) (see Appendix C for a list of member ports). Members of the WPCI are actively working on a variety of projects targeting climate change issues through activities and operations that can be applied worldwide. These projects include developing guidance for measuring a seaport's carbon footprint; guidance for increasing intermodal transport of cargo and reducing trucking; "green" lease templates; and testing innovative cargo handling equipment (CHE).

Members of the WPCI are also developing an environmental ship index (ESI) to measure the environmental performance of ocean-going vessels; the metrics focus on air quality and include a

shore power decision toolkit. Several ports indicated that they are conducting greenhouse gas assessments, retrofitting older diesel powered equipment and using cleaner burning fuels, or using other methods to reduce fuel consumption, such as purchasing hybrid equipment and vehicles.

With respect to conservation and waste minimization, a number of ports actively publish their efforts to reduce waste and increase recycling, particularly paper, plastic, metals, and construction debris. In Japan, the government recently developed a recycling standard in order to coordinate activities at its many seaport facilities. Several seaports highlighted their specific efforts to conserve water and energy. Some of these projects included installing water efficient fittings and energy efficient light bulbs. The Sydney Ports Corporation developed its own set of sustainability guidelines for tenant facility development and operations. The guidelines provide tenants and seaport operators with simple measures to improve environmental outcomes in key areas such as air quality, water consumption, energy usage, and waste management.

At least four major seaports were hubs for renewable energy using wind turbine technology. In most cases, the wind turbines on seaport property also supplied power to neighboring cities.

Much of the information about community programs focused on mitigation projects. In interviews with several seaports, these mandatory initiatives were considered a benefit to the community while also fulfilling regulatory requirements, and were designed with multiple purposes in mind. Projects included the development of parks, bird sanctuaries, and shore side community centers.

Of those international seaports interviewed, none identified a particular environmental program that they chose not to implement. Each indicated that a careful review of projects in the budget request phase was conducted to ensure that projects for consideration were appropriate and met the strategic goals of the port.

A majority of the North American seaports referenced global economic conditions, which have contributed to reductions in staff and other resources, as influencing their ability to implement environmental initiatives. Often, strategic partnerships have enabled ports to complete projects and studies that would have otherwise been beyond the financial reach of the individual seaports. Teaming with tenants, community groups, environmental organizations, municipalities, state and federal agencies (U.S. Environmental Protection Agency, the Department of Defense, Department of Transportation Maritime Administration, etc.), other non-governmental organizations, trade associations, and regional consortiums is becoming more commonplace, particularly when there are economic as well as environmental benefits involved.

U.S. seaports have also advanced sustainability projects through grant funding, which in turn has helped promote different strategies. For example, grants for air emissions projects, such as repowering and retrofitting existing equipment, have helped demonstrate the effectiveness of this approach to reducing emissions. This helps gain widespread acceptance within the industry for this practice. Especially for financially constrained seaports, grant-funded partnerships are the only way that pilot projects to test new equipment and innovative technologies can succeed.

RESEARCH HIGHLIGHTS

The information below details noteworthy examples of sustainable approaches and practices derived from the various interviews and literature search.

Air Quality

Seaports around the world are well aware of the impact their operations have on air quality. Often, the first place to start to address air emissions is through comprehensive inventories. Several international seaports, such as the Ports of Brisbane and Rotterdam, are currently undertaking emission inventories to understand the source and amount of air pollution and greenhouse gas (GHG) emissions generated from their activities. In November 2008, the IAPH held a meeting of the World Ports Climate Initiative (WPCI) to discuss potential resources needed to develop greenhouse gas and other air emissions inventories. Conference attendees articulated a clear need to concentrate on the development of industry-accepted emission inventory tools.

In N.A. seaports, air emissions inventories are being completed by some port authorities to create a baseline to better track changes in emissions over time. The Port of Portland conducted a baseline air emissions inventory in 2000 and a greenhouse gas emissions inventory in 2009. Across the Columbia River, the Port of Vancouver USA is in the process of completing its first inventory. For the Port of Portland, inventories have helped to identify and prioritize areas where emissions can be reduced. Further, the Port's work on this front has helped support emission inventory work led by organizations like The Climate Registry. The Climate Registry is a nonprofit collaboration among states, provinces, and native sovereign nations to set consistent and transparent standards to calculate, verify, and report GHGs. The Port of Portland is a founding reporter to The Climate Registry.

It appears that air emission inventories are being conducted on a voluntary basis and not to meet a regulatory requirement. Several U.S. seaports noted that by having up-to-date-inventories, it is much easier to prepare grant applications and meet National Environmental Policy Act (NEPA) requirements for federally funded projects. The research found that the smaller U.S. seaports do not have staffing or funding available to prepare voluntary air emission inventories.

The research also found that the inventories lead to a better understanding of air quality issues, which helps identify specific areas to reduce emissions from seaport operations. Approaches typically include a combination of replacement of older equipment with cleaner, more efficient models; repowering older equipment with cleaner burning engines; retrofitting equipment with emission controls; using cleaner-burning fuels such as natural gas, propane, ultra low sulfur diesel and biodiesel; and reducing idle times at facilities.

The Port of Rotterdam has launched two new low-emissions hydrographic vessels fitted with NOx catalyzers and soot filters into service. All ships owned by the Port Authority are powered by sulfur-free fuel. The replacement of the traditional, heavy polluting equipment will contribute to Rotterdam's goal of banning all polluting engines for inland shipping by 2025.

Similarly, the Port of Auckland has invested in hybrid diesel-electric straddle carriers credited with reducing fuel use. The straddle carriers generate 90 percent less particle emissions, use 20 percent less fuel, and make less noise than previous diesel-only models. In addition, the Port of Auckland recently installed a real-time monitoring SCADA (supervisory control and data acquisition) system to help identify opportunities for improvement and waste reduction in electricity and fuel consumption. The Port's engineering department achieved 25 percent energy savings by improving workshop lighting and compressed air systems as part of a wider energy conservation program.

Israel's Ashdod Port Company, Ltd., annually exports millions of tons of fertilizers (potash and phosphate). In the past, the bulk ships were loaded by means of a pipe loader that produced fugitive emissions of phosphate and potash dust. Through the combined efforts of the Port Company and the Israel Chemicals and Fertilizers Company, the old loaders with dust suppressors were replaced with Cleveland Cascade ecological loaders, resulting in a 95 percent reduction in air and water contamination from the loading process.

In the U.S., replacement of older equipment is a common practice among the seaports interviewed. This approach has been used when replacing diesel and gasoline fleet vehicles with hybrid and alternative fuel powered vehicles. Both the Port of Vancouver USA and Port of Portland currently use this approach to lower emissions; most of the seaports interviewed indicated that in the future, when new fleet vehicles are purchased, air emissions will be taken into account.

For cargo handling equipment like yard tractors, cranes, straddle carriers, and reach stackers, there are several pilot programs being conducted using both electric and hydraulic hybrid motors, as well as full electrification. Many of these pilot programs are being funded by partnerships consisting of port equipment manufacturers and regulatory agencies such as the U.S. EPA.

The research found that while hybrid passenger vehicles are only slightly higher in price than their gas or diesel counterparts, hybrid yard equipment can be considerably more expensive. The cost of a diesel-powered yard tractor is in the neighborhood of $85,000, while all-electric yard tractors cost close to $300,000.

Higher-volume seaports that replace equipment more often due to frequent utilization have found that replacing cargo handling equipment with new, cleaner burning power units can, in some cases, yield economic benefits. They are therefore more likely to upgrade to newer technologies than lower volume seaports.

Repowering projects at the seaports researched have mostly focused on large equipment such as rubber tired gantry cranes (RTGs), diesel powered ship-to-shore cranes, and harbor craft like tugboats, ferries, pilot boats, and workboats. In order for more seaports to utilize this emissions reduction strategy, the financial benefits have to be more attractive than buying new equipment, which is one reason why repowering larger and more expensive equipment makes more sense than repowering smaller equipment and vehicles. Retrofitting equipment and vehicles with emission reduction devices, such as diesel oxidation catalysts, is one of the more cost efficient ways to reduce emissions on most container-handling equipment and vehicles. Several seaports

said that retrofitting equipment was a good way to reduce emissions in the short term until the equipment could be replaced.

Retrofits of existing cargo handling equipment with emission reduction devices has been implemented at the Port of Vancouver USA through a Washington Department of Ecology and Department of Energy (DOE) grant program. Both the seaport and its tenants benefited from this grant-enabled project. In 2009, the Port of Portland retrofitted three reach stackers with diesel oxidation catalysts; these are in addition to three new reach stackers that were purchased in 2007, which included anti-idling features.

New purchases of diesel-powered cargo handling equipment must meet federal standards for new non-road diesel engines. Many seaports' efforts to reduce criteria air pollutants also reduce carbon dioxide, the primary greenhouse gas emitted from internal combustion engines. Diesel oxidation catalyst retrofits, however, may slightly increase the emission of CO_2, because the catalyst oxidizes carbon monoxide, gas phase hydrocarbons, and the soluble organic fraction of diesel particulate to CO_2 and water. It does, however, reduce the emission of carbon black, which, based on recent research, is believed to be a significant contributor to climate change.

Alternative fuels are another simple and widely accepted approach to reducing emissions. Ultra low sulfur diesel (ULSD) is used by seaports throughout North America. While the use of ULSD is a commonly used approach to lower emissions for non-road equipment, its use in road equipment is not universal.

Biodiesel and compressed natural gas (CNG) appear to be the least-utilized alternatives. Biodiesel is not used by seaports in ozone non-attainment areas because it increases the emissions of NOx, an ozone precursor. Of the seaports along the Columbia River, biodesiel usage is less common east of the Cascades, where lower winter temperatures can prove problematic for operations and where biodiesel is less available. The Port of Vancouver USA has successfully switched all of its compatible diesel equipment to a B20 biodiesel blend.

Another approach to emissions reductions is providing shore power for ships at berth. Discussions with various seaports indicate that the "low hanging fruit" regarding shore power involves resident harbor vessels, such as tugs and ships, at extended lay berth. The Port of Portland has implemented shore power for some of the tugs servicing the Port's Terminal 6 facility, the U.S. Army Corps of Engineers dredge vessels home ported at Terminal 2, and the Dredge *Oregon* and two barges at the Port's navigation base. MassPort is planning to provide shore power to its fish pier facility to power commercial fishing vessels while in port. The technology also lends itself to certain types of ships that have high power requirements and frequent return service to the same port, such as cruise ships, which require large amounts of energy while hotelling between voyages. Competition within the cruise industry means that ships operating from North American seaports are fairly new and replaced more regularly, which provides an opportunity for standardization of shore power equipment to service these vessels and a significant reduction in air emissions.

The infrequency of repeat same-ship visits makes shore power a much less cost effective option for smaller seaports compared with larger container seaports and cruise terminals. Shore power

viability depends on the type of operations, marine vessel types, and frequency of same-ship vessel calls. Other key limitations are the expense of retrofitting vessels and shore-side infrastructure and the lack of shore power infrastructure standardization.

The Port of Vancouver USA has equipped one berth with shore power as part of a contract for a long term lay berth of a U.S. Naval Reserve ship at one of its terminals. Lay berthing a vessel over longer periods of time allows customized electrical connections to shore power that can take several days to accomplish. Most cargo vessels are in port from less than a day to one week, and make this type of electrical connection impractical. The Port of Vancouver USA is developing a new marine facility on a former brownfield location and plans to install the infrastructure, such as conduits and vaults, as part of the initial development. At this time, however, the Port does not intend to install the remaining system requirements for shore power due to cost and a lack of standardization within the shipping industry.

The Port of Los Angeles (POLA), the largest container port in the U.S., has three container berths set up with cold ironing facilities, which the Port refers to as the Alternative Maritime Power, or "AMP." The AMP system was installed as part of a settlement to a lawsuit relating to air quality issues in the dense residential neighborhoods surrounding the port facilities. The effectiveness of the program is dependent on POLA's long-term agreements with cargo shippers and the fact that the same vessels repeatedly call the container facility. This allows the system to work efficiently, thanks to standardized equipment that connects the vessels to the AMP system. AMP has provided the seaport with assurances of a return on the significant capital investments. The Port of Long Beach also provides shore power at the ITS container terminal and at the British Petroleum (BP) Marine Terminal.

The Port of Rotterdam has shore power facilities for all inland shipping vessels, and the Port of Gothenberg, Sweden has provided shore power for ocean going roll on roll off (ro/ro) vessels for over a decade.

California seaports appear to have the most regulation of air emissions, largely due to their non-attainment of National Ambient Air Quality Standards. They have taken several measures to comply with both existing and ever-changing regulatory requirements. A number of these measures have been contentious with respect to California's authority to regulate interstate and international commerce, and are the subject of ongoing litigation. Measures include the development of the San Pedro Bay Clean Air Action Plan, in which the Ports of Los Angeles & Long Beach, the U.S. EPA, California Air Resources Board, and South Coast Air Quality Management District are working to reduce the health risks posed by air pollution from port-related ships, trains, trucks, terminal equipment, and harbor craft over a five year period. Among other facets, the seaports have implemented a Clean Truck Program that bans all pre-1989 drayage trucks from servicing the ports and progressively bans all remaining trucks that do not meet U.S. EPA 2007 emissions standards by 2012.

In Southern California, a voluntary vessel speed reduction program that extends to within 20 nautical miles has been implemented at the San Pedro Bay and San Diego Bay Ports. Ocean-going vessels must reduce speeds to 12 knots (15 knots for cruise ships calling in San Diego) in an effort to reduce air emissions. On a related note, ocean vessels calling on California seaports

are required through state legislation to burn low-sulfur distillate fuels when they are within 24 miles of the California coast and while at anchor and tied up at port facilities. Similar fuel standards have been proposed for vessels operating within 200 nautical miles from U.S. and Canadian coast; a U.S.-Canadian initiative is being considered for ratification by the International Maritime Organization Marine Environment Protection Committee in March 2010. Meanwhile, the U.S. EPA recently passed a new rule for fuel standards for U.S.-flagged ships. The new standards, passed in December 2009, are expected to reduce emissions of nitrous oxide and particulate matter by 80 and 85 percent, respectively, compared to current conditions.

Congestion of both rail and truck traffic is an issue that many seaports mentioned as an impact to air quality. Decreasing engine idling by relieving congestion through investment in road and rail improvements was either being implemented or was high on the list of future capital projects for several seaports. Many have invested heavily in on-dock rail infrastructure. Rail is a cost effective transportation mode for destinations over 500 miles, and a more efficient way to move heavy cargo: one ton of cargo can travel over 200 miles on one gallon of fuel when shipped by rail, versus just 59 miles when shipped by truck. When cargo destinations allow the use of rail, truck trips are reduced near terminals. Due to its remote location and small population base, the Port of Prince Rupert, British Columbia, moves the majority of its containerized cargo to off-site destinations via rail, with minimal use of trucks.

The Port of Portland is currently undertaking several rail improvement projects that will provide benefits at several of their terminals. Offsite rail yard improvements at the Ramsey Rail and South Rivergate rail yards will decrease congestion in the area and allow for more efficient assembly of unit trains servicing bulk commodity facilities located at the seaport. The Port of Vancouver USA is also completing a rail improvement project, known as the "West Vancouver Freight Access Project," that will provide similar benefits throughout their seaport facilities, including its new Terminal 5. Vancouver is also working with the Port of Portland, private businesses, and other government agencies on the Columbia River Clean Diesel Project, which will address reductions in emissions from diesel-burning engines.

Efforts to reduce vehicle idling are common. The State of Massachusetts has a law that restricts idling to a maximum of five minutes. The Massachusetts Port Authority helps implement this law through outreach to tenants, truckers, and the community, and by displaying informational signage at its facilities. The Port of Portland has worked with tenants and operators to turn off cargo-handling equipment during scheduled breaks and has added truck gate improvements to reduce gate processing times.

The Port Authority of New York & New Jersey has several projects designed to increase efficiency and reduce idling, including a $600 million project to develop an on-dock rail system for all of the Port's major container terminals. The Port is also investing in off-port regional rail improvement projects; a new Port Inland Distribution Network (PIDN) to promote an efficient barge and rail system for inland ports in New Jersey, Connecticut, and Rhode Island; and improvements to the electrical infrastructure to allow tenants to replace diesel cranes with all-electric cranes.

Often, initiatives are made possible by partnerships with tenants. The Port Authority of New York & New Jersey tenants have installed automated gate equipment, relocated gates, and extended gate hours to reduce truck delays and congestion. They have also modernized their non-road cargo handling equipment with equipment that meets the more stringent EPA on-road standards. Other initiatives at the Port include an agreement struck during a channel deepening project: the Port agreed to offset the air emissions created by completion of the project. The Port developed a Harbor Air Management Plan that retrofitted the Staten Island Ferry fleet and replaced engines on other marine vessels. This approach will provide air emissions reduction benefits well beyond the completion of the channel deepening project.

Air Quality	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
Cold Ironing/Shore Power	Yes	Yes	Yes	Yes	Yes
Ultra Low Sulfur Diesel - Distillate fuel use requirements- Landside/vessels	Landside & Vessels	Landside	Landside & Vessels	Landside	Yes
Biodiesel	Yes	Yes	No	Yes	Yes
Other alternative fuels (CNG, etc)	Yes	No	Yes	Yes	Yes
Rail Congestion Projects	Yes	Yes	Yes	Yes	Yes
Hybrid / Electric Yard Equipment	No	No	Yes	Yes	Yes
Hybrid/ Electric Fleet Vehicles	Yes	Yes	Yes	Yes	Yes
Clean Truck Program	No	No	Yes	No	N/A
Reduced Idling programs	Yes	No	Yes	Yes	Yes
Pollution control retrofit devices	Yes	Yes	Yes	Yes	Yes
Repowering of equipment	No	No	Yes	Yes	Yes
Equipment Replacement Programs	Yes	Yes	Yes	Yes	Yes
Reduced vessel speed	N/A	N/A	Yes	No	Yes
Formal Air Inventory	Yes	Yes	Yes	Yes	Yes

Climate Change

The initiatives in the Air Quality section not only address local air quality issues, but also address the broader issue of global climate change. In March 2008, the Port Authority of New York & New Jersey Board of Commissioners committed to carbon neutrality from its operations by 2010. The agency plans to accomplish net zero annual carbon emissions from its operations

through capital investments and operational refinements, and by offsetting its remaining emissions through regional investments in environmental technology.

More common is the completion of greenhouse gas inventories. In 2008, the Port of Auckland became one of the first seaports in Australia to measure and audit its GHG emissions and carbon footprint. Their inventory of total greenhouse gas emissions was audited by PricewaterhouseCoopers. The Port of Portland's greenhouse gas emissions inventory was completed in June 2009 and will be independently verified by a third party by March 2010. Results from the inventory have helped to justify the purchase certified renewable energy credits covering 56 percent of the Port's annual energy use.

As stated previously, the World Port's Climate Initiative (WPCI) has committed to develop a series of tools to support seaports' efforts to minimize contributions to climate change. Of those seaports reviewed, several are members of the WPCI and are making significant commitments to address global warming. For example, the Port of Rotterdam is striving to achieve 50 percent reduction in CO_2 by 2025 compared to 1990 baseline.

The Port of Brisbane has undertaken a detailed review of possible sea level rise and implications for port design. Its wharves are estimated to be approximately 1.5 meters above the sea level rise expected in 2100. This elevation was selected on the basis of maintenance and operational issues resulting from sea level rise. They are currently waiting for a consultancy report on the implications of climate change on trade volumes and on other characteristics of the port.

Sydney Ports Corporation is working closely with tenants, local council, and state government to ensure that port infrastructure and port operators are prepared for the impacts of climate change by preparing a Climate Change Risk Assessment and including climate change mitigation factors in development applications.

Climate Change	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
Greenhouse gas inventory	Yes	No	Yes	Yes	Yes
Carbon footprint calculation	Yes	No	Yes	Yes	Yes
Carbon neutral commitment	No	No	No	Yes	Yes
Green buildings	Yes	No	Yes	Yes	Yes
Climate change risk assessment	Project based	No	Yes	Yes	Yes
Operational changes	Yes	Yes	Yes	Yes	Yes

Water Quality

Water quality issues in waterways and bays throughout the U.S. are driving more aggressive management of stormwater runoff from port and tenant facilities. The general trend is for stormwater discharge limits to become more restrictive with each permit cycle. N.A .seaports are encountering additional regulatory challenges as state environmental agencies develop Total Maximum Daily Load (TMDL) implementation plans for water quality-impaired water bodies

that must be submitted to EPA for approval. Once a TMDL is completed and approved, states are obligated to incorporate the TMDLs into stormwater permits. This process generally leads to more restrictive levels of constituents allowed in runoff from seaport facilities.

The N.A. seaports that were researched and interviewed for this project are regulated under different permit scenarios that include:

- General NPDES stormwater permits for port managed operations;
- General NPDES stormwater permits for tenant managed operations;
- NPDES Municipal Separate Storm Sewer System (MS4) permits for the port owned systems, regardless of industrial activities;
- A combination of these approaches.

Several of the N.A. seaports interviewed are regulated by MS4 permits as sole permit holders or as a co-permittee with local communities. MS4 permit requirements include programs for public education and outreach, illicit discharge detection and elimination, construction site runoff controls, post construction runoff control and pollution prevention, and good housekeeping practices for operations. Operators of regulated MS4s are required to develop a stormwater management plan (SWMP) that includes measurable goals, and to implement best stormwater management practices (BMP). The Port of Portland and Port of Vancouver USA have general stormwater permits for facilities they operate as well as being covered by MS4 permits.

To comply with their MS4 permits, a number of seaports have taken the opportunity to develop stormwater design guidelines on their own or in conjunction with co-permittees. By developing their own design guidelines and management manuals, they can tailor the guidelines to their specific facilities and take into account unique operational and geographical constraints and issues. The Port of San Francisco, in conjunction with the City of San Francisco and San Francisco Public Utility Commission, developed its own guidelines to address issues specific to the facilities. The Ports of Los Angeles and Long Beach are also developing a stormwater management manual as part of their Water Resources Action Plan (WRAP) requirement.

To improve stormwater quality in runoff from their facilities and in order to comply with their water quality permits, N.A. seaports are implementing a variety of stormwater solutions. One trend is to limit stormwater from reaching adjacent water bodies by infiltrating as much runoff into the ground under their facilities as possible. Use of infiltration swales, drywells, and pervious pavement applications are becoming more common ways to address stormwater runoff issues. Pervious pavement has been successfully utilized at the Port of Portland's Terminal 6 auto import facility, and several other seaports are investigating its use. The Port of Everett has converted a former log yard into a vegetated bio-filtration swale to accept stormwater runoff from the surrounding area. When infiltration of stormwater is not a possibility, seaports are employing the use of treatment devices such as oil/water separators, filter systems, cyclonic devices, rain gardens, biofiltration or vegetated swales, and quiescent basins.

Water quality requirements and endangered species recovery plans within the Columbia River Basin are driving the river system seaports to aggressively address stormwater issues. Stormwater discharge limits have become more restrictive with each permit cycle. Many of the

seaports along the Columbia River in Washington State have, to the extent practical, eliminated stormwater discharge to the river. They have done this by routing their stormwater into drywells, infiltration basins, and/or modified existing site features to allow for infiltration. The Port of Vancouver USA has implemented treatment for the majority of the stormwater running off of their facilities through the use of detention ponds, biofiltration swales, and hydrodynamic separation units. One of the Port of Vancouver's tenants, a metal shredding and recycling company, has implemented an electro-coagulation system to treat the stormwater from their operation which is then discharged under an individual NPDES permit.

The Ports of Los Angeles and Long Beach are developing a stormwater management manual as part of their Water Resources Action Plan (WRAP). WRAP is being completed in cooperation with the U.S. EPA, state environmental, and local governmental agencies to ensure that the seaports' operations and programs and their tenants support the attainment of full beneficial uses of harbor waters and sediments, and to prevent operations from degrading existing water and sediment quality. The plan integrates several programs and initiatives that address sources, including land use discharges from facilities, on-water discharges, and sediment and watershed discharges from outside the port controlled facilities.

Water conservation programs at the seaports researched appear to be centered on addressing water usage associated with landscape irrigation and through the use of water flow restriction devices in buildings on port facilities. The use of water-saving irrigation systems and components to reduce the amount of water used for irrigation of landscaping is becoming more common because it provides a financial incentive by reducing water use expenses. In the early 1990s, the Port of Portland installed drip irrigation in several miles of plantings that it maintains in the industrial park adjacent to its container terminal; "smart" irrigation systems that use real-time meteorological data have also been installed at port industrial developments around marine facilities.

Xeriscaping, the use of native and drought tolerant plants, is another approach employed to reduce water consumption. Low-flow plumbing fixtures and devices are consistently used in administration buildings at many of the seaports researched. The reuse of gray water is complicated by a need to change plumbing codes in many areas and therefore has not been implemented widely; however, this may change as seaports strive to achieve Leadership in Energy and Environmental Design (LEED) certification from the U.S. Green Building Council for new structures on their facilities.

As expected, water conservation programs are important to California seaports. The Port of San Diego has completed a water audit of its administration building that resulted in the installation of water efficient plumbing fixtures, resulting in an expected 10 percent reduction in water use. The Port of Oakland has developed a Clean Water Program that incorporates a four-step process for pollution control, including training employees on stormwater impacts, inspecting industrial tenants, monitoring stormwater runoff, and commitment to continuous improvement in operations to control stormwater pollutants.

Water conservation programs for the Columbia River ports appear to be limited. Several of the seaports indicated that they will address water conservation during the design and construction of

new buildings on their facilities. Many of these seaports use native and drought tolerant plants to limit or eliminate the need for irrigation.

Seaports around the world wrestle with the same water management issues as N.A. ports, and therefore use many of the same conservation tactics. For example, the Port of Brisbane was able to reduce its overall water consumption by 75 percent using best management practices like water-efficient fittings, education, and alternatives to potable water. In addition, Brisbane found alternatives to using potable water for 95 percent of the construction activities around the Port and by forecasting its anticipated construction activities. It currently recycles water required to cure each section of concrete wharves by capturing the water in a tank and re-applying it.

As part of its stormwater management program, the Port of Brisbane developed a program to harvest the aquatic weeds that grow in a lake on their property. The lake plays a critical role in stormwater management by settling and filtering stormwater from the surrounding roads and motor vehicle storage areas. Regular harvesting of these aquatic weeds keeps the lake system healthy. In 2008, the seaport removed in excess of 150 tons of weeds, which were then dried and used as mulch at the Whyte Island re-vegetation project.

To address ballast water concerns, the Port of Amsterdam developed a program that offers an "environmental" discount on port dues. Tankers with a Segregated Ballast Tank (a ballast tank separated from the cargo oil) can be eligible for a discount of 17 percent on seaport dues, thereby offering a "business case" for shipping lines to utilize tankers with segregated ballast tanks.

Water Quality	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
Stormwater Infiltration swales/facilities	Yes	Yes	Yes	Yes	Yes
Pervious Pavement	Yes	No	No	No	Yes
Cyclonic Devices	Yes	No	Yes	Yes	
Filtering Devices (e.g. stormfilter)	Yes	Yes	Yes	Yes	Yes
Engineered systems (e.g. electro-coagulation)	No	Yes	Yes	Yes	
Oil/Water Separators	Yes	Yes	Yes	Yes	Yes
Development of Port specific development standards	No	No	Yes	Yes	Yes
Water Conservation projects/program	Yes	Yes	Yes	Yes	Yes
Plumbing/irrigation retrofits	Yes	Yes	Yes	Yes	Yes
Ballast Water and Hull Fouling Program	No	No	Yes	Yes	Yes

Waste Minimization

Based on the information made available by the data pool, the majority of seaports have some type of waste recycling/minimization program in place – mostly for paper, metals, glass, and construction debris.

To streamline the recycling process and provide consistent guidance, the Ports and Harbors Bureau, Ministry of Land, Infrastructure and Transport in Japan prepared guidelines for the handling of recyclable materials at ports countrywide. These guidelines have helped alleviate problems concerning the handling of recyclables at Japanese seaports between various port management bodies and governments in the region. The guidelines include the establishment of a Recycle Ports Promotion Council to enable participation by diverse groups including local government and various industries such as steel, cement and logistics, and recycling firms.

Partnerships for waste minimization were evident throughout the research. For example, to address the issue of reuse of contaminated dredge materials, the Maritime and Port Authority of Singapore (MPA) partnered with a local company, New Earth Pte Ltd., to develop an award winning technology that treats contaminated dredged materials and industrial waste, converting them into environmentally safe construction and reclamation materials. This reduces or eliminates disposal and potential pollution issues arising from port and marine activities such as dredging, and disposal of maritime wastes such as oil sludge and copper slag.

The majority of seaports that were researched and interviewed were fairly large organizations, with administrative components that generate large quantities of office related waste (paper, cardboard, etc.). Recycling programs for this waste were common; many seaports have in-house recycling programs and participate with local municipalities to maximize their recycling efforts. Several seaports indicated that municipal ordinances drive their programs to achieve various levels of recovery of recycled materials.

Recycling programs that address vehicle and equipment maintenance are common: oil, batteries, tires, antifreeze, metal, plastic containers, and other waste products are collected through formal programs at numerous seaports. Still, a number of the seaports contacted indicated that over the last year, recycling programs that once broke even or even generated a small profit have become money-losing operations due to the downturn in the economy and the subsequent drop in value of recycled commodities. While most plan to continue with their programs, decisions to drop specific commodities that do not pay to recycle may have to be made.

Construction project-related recycling is widespread. Construction and demolition projects are generally of a large scale and provide excellent opportunities for cost-effective recovery of large quantities of construction debris including metal, wood, concrete, and asphalt.

Small scale food waste composting programs have been implemented at several seaports around the world. Larger scale composting of landscape debris was also noted at a few of the seaports researched.

Similarly, examples of seaports that have implemented electronic waste (e-waste) recycling programs, including e-waste collection events for their tenants, were identified. A number of seaports donate old computers to local schools and to non-profit groups for reuse.

Several seaports include reduce-reuse-recycle policies as part of their environmental management and sustainability programs. The inclusion of waste minimization and recycling into these programs allows them to set measurable goals and objectives for their activities in order to track success and to identify areas of improvement.

The majority of the Columbia River seaports are small compared to the Port of Portland and the Port of Vancouver USA. The smaller ports' operations do not generate enough quantities of waste to require formal recycling programs, and they often utilize the recycling programs that are developed by the communities in which they operate. In addition, the smaller Columbia River seaports often work with their tenants to encourage recycling efforts.

The Port of Vancouver USA approaches recycling as part of its sustainability program. Vancouver has developed a formal sustainability plan for its facilities and works with its tenants through a tenant outreach program. The program emphasizes the recycling of office waste, wood waste, and metal, as well as more unique recycling opportunities, such as composting of food waste. The completion of waste audits assists the seaport in developing plans to address recycling efforts in the most cost effective manner.

The Port of Portland, a consolidated seaport including Portland International Airport, has an extensive waste minimization program that includes metals, all plastics except PVC, and food waste.

Waste Minimization	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
In-house Recycling Programs	Yes	Yes	Yes	Yes	Yes
Rely on community programs	Yes	Yes	Yes	Yes	Yes
Office waste related	Yes	Yes	Yes	Yes	Yes
Vehicle and Fleet Maintenance related	Yes	Yes	Yes	Yes	Yes
Construction Waste related	Yes	Yes	Yes	Yes	Yes
Electronic waste related	Yes	Yes	Yes	Yes	Yes

Dredging

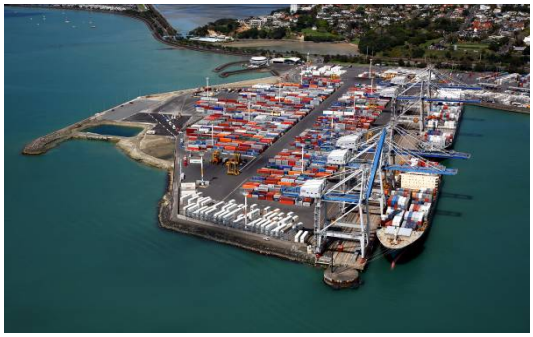
Dredging activities are conducted to maintain existing channels and berths and to develop new facilities. While many of the seaports reviewed included brief information about dredging operations on their websites, few included more detailed information about specific activities or projects. Where information was published, dredged material was typically reused in natural resource mitigation as upland fill or in the development of new terminals although some seaports face challenges with contaminated dredge material.

In the U.S., environmental regulations for dredging activities are extensive, and obtaining permits for dredging projects can take years. Water quality and endangered species concerns influence the way seaports conduct dredging projects. For instance, in-water work periods developed for the protection of endangered species regulate the time and duration of dredging activities. Extensive planning is needed to accomplish projects during these in-water work periods. Any delay in permitting, designing, or contracting can delay a project until the next in-water work period, sometimes causing project delays of up to a year.

Frequently at U.S. seaports, extensive sampling is required to determine how sediment is handled. Several of the ports noted that biological testing of sediment is becoming a common requirement.

Many of the large seaports have few options for placement and disposal of dredge material, depending on the quality and potential contamination issues associated with the material. Due to its size and the amount of dredging required, the Port of Los Angeles has developed several scenarios for placement of dredge material. Strategies employed include shallow water habitat creation, fill material for upland projects, confined disposal sites, submerged storage sites, ocean placement, and upland disposal sites.

Some seaports, including the Ports of Auckland in New Zealand, use their dredging material to form new land. The dredged materials are mixed with cement to make mudcrete for the reclamation. The Ports of Auckland have used hundreds of thousands of cubic meters of dredged fill and approximately 40,000 cubic meters of rock from the Wiri Inland Port to form new land and pavement.



Port of Auckland – land on left side of photo formed by reclaimed dredge material

The Port Authority of New York & New Jersey has been able to use more than 49 million cubic yards of dredged material for beneficial reuse. The Port Authority used treated dredged material to cap a brownfield site that was later developed into a commercial shopping mall and golf course. The Port Authority has also provided funding for a bi-state fund to support dredging projects, and is investing in a Contaminant Assessment and Reduction Program (CARP) to assess the source of all contaminants of concern in water, sediment, and biota within the New York and New Jersey Harbor Estuary. The goal of the CARP program is to assess the level of contaminants in the harbor and then use modeling results to predict the movement of contaminants so that strategies for reduction can be developed.

The Port of Everett is the local sponsor of the U.S. Army Corps of Engineers' annual maintenance dredging for the navigation channel and settling basins on the lower Snohomish River near its facilities. As the local sponsor, the seaport provides upland sites for dredge material placement. The Port has used the dredge material for beneficial reuse on an island to extend and nourish the sand berm that protects a high quality salt water lagoon ecosystem, and has also used the material to create additional shoreline in front of a breakwater protecting one end of the island. A unique benefit of the placement of the dredge material has been the suppression of invasive plant species on the island's uplands.

The Port of Charleston has designed and installed a "Sediment Suspension System" to address the need for frequent maintenance dredging activities. The system consists of hydraulic water units that power water jets, which keep sediments from settling or shoaling in the berth. Charleston reports that it has experienced operational and financial benefits with the system, without a net negative effect on the environment or the aquatic life. This approach to address maintenance dredging issues may not be applicable to all locations due to potential endangered species issues and contaminated sediment issues; however, the system has been successful at limiting the need for annual maintenance dredging activities at the facility for which it was designed.

Partners with the Port of Baltimore remove approximately 4.7 million cubic yards of dredge material annually from its harbors and navigation channels. In 2010, placement of dredged material at open water sites in Chesapeake Bay will no longer be allowed. As a result, the seaport plans to implement "innovative reuse" strategies for the material. Examples of innovative reuse include capping landfills or brownfield sites; incorporating dredged material into lightweight

aggregates; reclaiming lands impaired by sand, gravel, and coal mining; manufacturing bricks and blocks; enhancing degraded farmland; producing manufactured topsoil, and creating fill for construction projects. Port officials expect the challenges to these uses will be sediment quality, regulatory constraints, public acceptance, and cost.

Most of the Columbia River ports conduct maintenance dredging activities, although the Port of St. Helen's Port Westward facility is the exception, due to the natural scouring at the berth that results from the river's hydrology. Maintenance intervals at the Columbia River ports vary from annually to an eight-year cycle. Some seaports hire private contractors to complete maintenance dredging, while others rely on the U.S. Army Corps of Engineers. Placement of dredge material varies, with some seaports employing upland placement and others using in-water placement. In 2010, the Port of Vancouver USA plans to complete deepening of its berths to 43 feet to match the depth of the Columbia River channel, which is currently being deepened from the mouth of the Columbia to the Interstate 5 Bridge to a depth of 43 feet. Vancouver hopes that beneficial reuse of the material will be possible for upland placement.

Dredging Activities	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
Beneficial reuse	Yes	Yes	Yes	Yes	Yes
Sediment suspension	No	No	Yes	Yes	No

Energy Conservation and Renewable Energy

International seaports are striving to address energy challenges in a multitude of ways. Several have invested heavily in renewable energy as part of new development projects or in partnership with their host cities.

The Port of Rotterdam has established itself as a test area for innovative and sustainable technology deployment as part of its strategic planning goals. Many of the technologies used on the new Maasvlatke 2 Terminal will be equipped with innovative technologies that emit less CO_2. Rotterdam is also aiming for a three percent reduction in annual energy use. Residual heat from companies in the port complex is used to provide heating and cooling to houses, hospitals, and businesses around the city. In addition, the seaport has developed liquid natural gas terminals and is supporting production and transshipment businesses for biofuels. The biomass for these businesses must be produced sustainably, so work is on-going in a number of areas for the certification of sustainable biomass for these businesses.

With respect to renewable energy, the Ports of Setana, Muroran, and Kitakyushu in Japan currently have ocean wind turbines to generate alternative power for port requirements and to supply power to the local communities surrounding the seaports.

Likewise, the Port of Amsterdam has developed the biggest wind power facility at a seaport; using nine 3-megawatt wind turbines, it produces enough electricity for about 20,000 households. In addition, a new Greenmills biodiesel plant on Kretaweg (Kreta Road) is being built at the Port of Amsterdam. The plant will convert organic residual waste and organic waste flows into biofuels and green power on a large scale. When the plant becomes operational, it will employ approximately 130 people. Greenmills is a self-supporting plant that will produce its own electricity and heat by processing organic residual waste; it will also supply electricity to the main grid and generate sufficient green power to supply the equivalent of 35,000 households.

Many U.S. seaports are implementing energy conservation and renewable energy strategies at their facilities and are conducting outreach to their tenants. Different approaches are being used, including a number of partnerships with local utilities and tenants. Several seaports rely on the ability to purchase "green power" or renewable energy credits from their energy providers in order to address renewable energy goals. This approach was most common on the West Coast, with several seaports having specific goals for a certain percentage of their power purchases to be from renewable sources. The Port of Portland, which for years has purchased ten percent renewable power annually, recently upped its purchase to 56 percent certified renewal power. The Port was able to increase its allocation because of increasingly competitive rates in the certified renewable marketplace.

The installation of renewable energy sources such as solar or wind power generation equipment is being implemented on some port facilities, often in partnership with tenants and electricity providers. North American seaports implementing or exploring these initiatives include New York/New Jersey, San Diego, San Francisco, Baltimore, and Long Beach. Several additional seaports are investigating the potential for solar and wind projects by hiring consultants to conduct feasibility studies. The Port of Corpus Christi is currently in the early stages of development of a wind turbine project to be completed on its property. Of the seaports that are currently looking at installing renewable energy projects on their facilities, a number stated that these projects are on hold pending an improvement in economic conditions.

Based on the research, cruise terminals are a popular choice for the installation of solar equipment. The Port of San Diego is partnering with the local power utility to install solar cells as part of its Broadway Cruise Pier development. The seaport expects that their portion of the project will provide 12 to 15 percent of the energy load for the cruise terminal building. San Diego has formed another partnership with their local utility to identify programs to deliver net energy savings, peak demand savings, and greenhouse gas reductions through the implementation of energy efficiency activities related to port operations.

The use of renewable energy on the Columbia River seaports is limited to the purchase of renewable energy credits through local electric utility providers. The Port of Vancouver USA purchases Pacific Northwest wind farm-generated renewable energy credits equivalent to 60 percent of their energy usage, and have participated the EPA's Green Power Partnership program. The Green Power Partnership is a voluntary program that supports the procurement of green power by offering expert advice, technical support, tools and resources to assist participants in identifying green power alternatives.

Most of the Columbia River seaports contacted have completed or are in the process of trading out older inefficient bulbs and fixtures with more efficient bulbs and fixtures in office buildings and maintenance areas, as well as on the terminals themselves.

Energy Conservation & Renewable Energy	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
On site solar or wind projects	No	No	Yes	Yes	Yes
Renewable power purchased through local utility	Yes	Yes	Yes	Yes	Yes
Facility energy audits	Yes	Yes	Yes	Yes	Yes
Lighting Replacement Projects	Yes	Yes	Yes	Yes	Yes

Natural Resources

All of the seaports interviewed affect and are affected by natural resources. Wetland and shoreline management is a universal issue that all seaports encounter in both day-to-day operations and during project development and construction. Salt water, estuary, and freshwater locations present different challenges that prevent the use of a "one size fits all" solution to management of these unique environments. Each solution must be tailored to the specific ecosystem that is impacted by operational and development activities conducted by the seaports.

Because of the nature of their business, seaports are located in environmentally sensitive areas. Accordingly, they engage in natural resource management on a daily basis. This may consist of routine management, implementing mitigation projects, or managing for invasive species. A number of seaports describe different mitigation projects with an emphasis on natural resources stemming from port development. For example, the Port of Rotterdam is restoring the brackish water environment in the Lake Oostvoornse Meer by creating a salt water inlet. Brackish water environments are rare near the Port's facilities and support a highly specific ecosystem with unique flora and fauna. In addition, the seaport's new Terminal, Maasvlatke 2, is being constructed within a protected area of the North Sea. Other protected areas in the vicinity include vulnerable sand dunes. As part of the mitigation, the Port has designated "soil protected areas" at a rate of ten times the area of the new terminal being developed.

Other seaports have fostered partnerships with land conservancies or communities to proactively ensure sustainable approaches to natural resource management. For example, the Port Autonome du Havre has partnered with the Normandy Seine Regional Nature reserve to create pastureland for Camargue horses in a reed bed on the banks of the Seine River estuary. Camargue horses are semi-wild horses that live in wetland areas at the mouth of the Rhone River. The presence of the

horses limits the growth of trees and supports diversity among the plant base. The project is fully supported by funding from the seaport and includes the purchase of additional horses, their introduction into the reserve, maintenance, fencing, and veterinary support.

The proximity of seaports operated by the Associated British Ports (ABP) to many important habitats presents a variety of opportunities to maintain and enhance biodiversity.ABP works with the Royal Society for the Protection of Birds (RSPB) at Blacktoft Sands nature reserve to create pools which will attract Bitterns, a species of bird that has become extremely rare in recent years, due to loss of habitat. At ABP's Port of Immingham, Lincolnshire Wildlife Trust has partnered with the Port to identify opportunities to enhance wildlife as part of its general property management activities.

The Port of Brisbane's Moreton Bay is recognized as a wetland of international significance. Many of the shorebirds that visit the mudflats are migratory species protected by the Japan Australia Migratory Bird Agreement (JAMBA) and the China Australia Migratory Bird Agreement (CAMBA). In recognition of the significance the Port's reclamation areas play in providing high-tide roost habitat, it constructed a 29.65 acre shorebird roost on the south-eastern side of the port. It is the largest constructed shorebird roost in eastern Australia and provides for both conservation and education management of shorebirds.

The Port of Sydney partnered with the community and committed $30 million AU to a community investment project. As part of its Port Botany Expansion (PBE) Project, the Port will expand the existing habitat for the many shorebirds native to the area as well as to provide recreational facilities for the local community.

Port of Sydney – Port Botany Expansion

Several seaports interviewed have formal wetland mitigation and shoreline protection programs, while others handle issues on a case by case or project by project basis. Different scenarios were identified for development and management of mitigation projects, including in-house programs that design, construct, and provide long-term management and monitoring of mitigation sites. Another common approach is for seaports to team with local municipalities, state agencies, and community groups to complete mitigation projects either on port-owned properties or at other locations within the watershed. Yet another approach is to provide financial support for projects that are being completed by entities at off-site locations in order to obtain mitigation credits to offset wetland impacts on seaport facilities. Several seaports have successfully established mitigation banks by creating or enhancing wetlands both on and off their properties prior to the need for the mitigation. The establishment of mitigation banks has several benefits, including the ability to quickly respond to natural resource requirements for development projects. Mitigation bank projects can also support large, high-quality wetlands that have significant biological benefits compared to several small, disconnected wetlands.

Wetland mitigations strategies differ from seaport to seaport, and region to region. The Port of Anchorage is currently constructing a terminal expansion project that will require as much as 12.3 million cubic yards of fill along a new dock structure and in yard areas. The Port is funding

a mitigation bank at a rate of $1 million a year, and a committee has been formed with community and regulatory stakeholders to determine where in the watershed the funding will be utilized.

Endangered species concerns affect many of the seaports contacted. Even though specific situations differ, from marine mammals and sea turtles in Florida to salmonids along the West Coast, the need to effectively manage endangered species issues is a common concern. A unique example of how endangered species can affect projects is at the Port of Anchorage's terminal expansion project. Throughout construction of the project, the Port must employ observers to monitor the work area for the presence of Beluga whales. If a whale is spotted, all work must stop until the whale leaves the area.

Seaports, and the ships that call on them, are also monitoring the potential for introducing invasive species through ballast water. Several seaports have initiatives to address ballast water, including outreach to shippers, tenants, and the general marine community about the potential impacts of invasive species from the discharge of ballast water. The Port of Baltimore entered into an agreement to create the Maritime Environmental Resource Center (MERC), which will provide test facilities for pilot scale and shipboard testing of ballast water treatment systems. The MERC will assist ship builders with decision making tools to determine the most appropriate type of system for their applications. Partners in the program include the University of Maryland, U.S. Maritime Administration, National Oceanic and Atmospheric Administration (NOAA), Smithsonian Environmental Research Center, American Bureau of Shipping, and other shipping industry representatives.

The management of natural resources for the Columbia River seaports interviewed centers on endangered species and wetland issues. These issues are most often encountered during development projects and during maintenance of in-water structures. Formal full time natural resource staff appears limited to the Port of Portland. The remaining seaports approach natural resources issues on an as-needed basis. The projects are then managed by staff members that have other responsibilities, including environmental, planning, and operations.

Discussions with the seaports interviewed indicate that wetland mitigation projects are completed to comply with regulatory requirements when development projects are undertaken. The projects are generally completed on port owned properties; however, some projects have been completed at offsite locations. Onsite wetland mitigation sites are managed and maintained by the seaports and have been integrated into their stormwater management systems.

Partnerships with communities, regulatory agencies, and citizens' groups were found at the ports of Vancouver, Pasco, and Longview. The Port of Vancouver USA is a member of the Vancouver Lake Partnership, which brings together federal, state, and local public agencies and citizen stakeholders with an interest in Vancouver Lake and its watershed. The Port of Pasco Washington has teamed with the City of Pasco to complete a riverfront trail that includes a riverbank restoration component.

The Port of Longview Washington completed a unique land sale to the Columbia River Land Trust, which is a land conservation group with a mission to conserve in perpetuity the scenic and

natural values of the land and waters of the Columbia River. The property was originally purchased prior to 1974 for industrial development; however, mitigation requirements deterred development and the property was used as mitigation for industrial development. The land sale to the Columbia River Land Trust included 237 acres and the transfer of 75 mitigated acres. The Port of Longview retained ownership of 76 acres of the property for future mitigation and also retained the first right of refusal to mitigation credits derived from the 237 acres that they sold. This arrangement allows them to transfer maintenance and monitoring of the wetlands to the Columbia Land Trust while maintaining the opportunity to receive mitigation credits for future development.

The Port of Vancouver USA is currently establishing a wetland credit mitigation bank. The area will include enhancement of lower quality wetlands and the creation of additional wetland areas. The wetland credits will be used for various Port projects with excess credits available for sale to the public.

The Port of Portland has one of the more the comprehensive natural resource management programs. Initiatives include aggressive invasive species controls, projects to reduce wildlife mortality, and voluntary initiatives to create habitat for threatened species. The Port also actively manages over 750 acres of wetland mitigation sites.

Natural Resources	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
Formal Natural Resource Program	Yes	No	Yes	Yes	Yes
Case by case approach	No	Yes	Yes	Yes	Yes
Wetland mitigation bank program	Yes	Yes			Yes
Partnerships w/ communities, state agencies, regulatory agencies and citizens' groups	Yes	Yes	Yes	Yes	Yes
Threatened, Endangered and Protected Species Issues	Yes	Yes	Yes	Yes	Yes
Invasive species program	Yes	Yes	Yes	Yes	Yes

Sustainability

Sustainability can mean different things to different organizations, and many organizations handle sustainability matters without using a formal program.

The port sector builds and develops new terminals consisting of buildings, storage yards, truck gates, rail yards and marine structures. As these projects are initiated, some seaports have

utilized sustainable design and construction criteria as the thrust of their sustainability program For example, the Port of Sydney has been using its *Green Port Guidelines* and other examples of sustainable building criteria to inform the design of its new Operations Center, which is planned for Port Botany. The Center will centralize shipping control for Sydney's ports, bringing together navigation, pilotage, communications, and other functions. The Port of Sydney is aiming for a 4.5-star Australian Building Greenhouse Rating (ABGR) and, if possible, a five-star certification from the Green Building Council of Australia's Green Star rating scheme (similar to the U.S. Green Building Councils LEED Certification). Examples of the environmental initiatives being considered include: water and energy efficient appliances and amenities; photovoltaic panels on the roof; chilled beam air conditioning; passive solar design; and a 10,000 liter stormwater capture tank to provide for landscaping and toilets. In addition, tenants and port operators proposing to undertake development on the Port of Sydney's land are encouraged to incorporate suggestions from the *Green Port Guidelines* during the planning and application stages.

International ports are much more inclined to embrace sustainability and include community and quality of life aspects are part of their initiatives. The Port of Cape Town developed criteria for sustainable port development; its *Vision for Sustainable Port Development* includes requirements for supporting strong stakeholder engagement and integrating aspects of the triple bottom line (biophysical, social, and economic) into all levels of decision-making, from policy formulation to planning, design, construction, and operation.

In the Netherlands, and especially in the western metropolitan area of the Randstad, open space is a scarce resource and often presents a contentious issue for seaport activities. The Port of Amsterdam helps companies identify preferred locations to minimize nuisance factors and improve efficiencies; for example, the effort promotes reduced transport distances between associated operations. When new companies are established, special attention is paid to site size, location relative to other companies, and to the overall infrastructure of the area. The Port of Amsterdam also works on large scale restructuring projects to prepare whole areas for redevelopment. Restructuring targets the return of old leased sites that are not being used to their best capability and intensifying business activities in relationship to space usage.

Research results on sustainability indicated that there is a wide range of the types of sustainable practices and programs at North American seaports, and in the level of implementation. Due to staffing and finances, many smaller N.A. seaports interviewed have a limited ability to create formal programs. Other seaports find that discussions and decisions related to sustainability focus on new construction and development, and even more specifically on green building. When it comes to buildings and development, seaports increasingly rely on the LEED Green Building Rating System, developed by the U.S. Green Building Council.

However, several U.S. seaports have developed their own development standards and guidance manuals for design and construction of new and redeveloped facilities. The standards and guidance incorporate such elements as Low Impact Development Standards (LID) and LEED requirements. Many seaports have policies in place that require new construction to meet a specific LEED certification level. The Port of Tacoma has a policy that dictates that a LEED gold or higher certification is required for new buildings. The Port of Portland operates in the state of Oregon, which requires that public entities spend 1.5 percent of the total price of new

public buildings on solar building technology; the Port's new headquarters building for administrative staff will meet this goal while also meeting LEED Gold certification.

The Port of San Diego's Broadway Pier development for cruise terminal operations has been designed to meet LEED Silver certification. The design is expected to achieve at least a 25 percent greater water and energy efficiency than conventional design. The Port of San Diego is also currently reviewing an "Environmentally Preferable Procurement Policy," with a pilot program planned to test green products and assess their performance.

MassPort, the Massachusetts Port Authority, has developed and implemented a "Sustainable Design Standards and Guidelines (SDSG)" program. The SDSG is a certification program that includes performance standards for sustainable design, an implementation process, and a documentation system that is required for all MassPort capital projects. The SDSG guides project teams to minimize negative impacts and maximize positive benefits to the environment, the surrounding community, and the economy, while ensuring the financial viability of the seaport. The Port of Long Beach is also undertaking the development of sustainable design and construction guidelines for implementation by the end of 2010.

The Port of Vancouver USA has a formal sustainability program, with explicit commitments to the health of the economy, the community, and the environment. The program uses an internal sustainability team that creates goals and identifies ways to improve port operations. Sustainability measures are tracked and reported at the conclusion of each year.

The Port of Portland has a similar program of objectives and targets. For the past nine years, the Port has established annual targets to reduce environmental impacts, improve efficiencies, and conserve water, energy, and other resources; results are published each fall. In 2009, the Port adopted a formal Sustainable Natural Resources Policy that highlights the existing environmental programs, while defining the ways in which the Port makes decisions for the long-term environmental, economic, and social health of the community in which it operates.

Sustainability	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
Utilize LEED certification program	Yes	Yes	Yes	Yes	N/A
In-house sustainable development standards	No	No	Yes	Yes	Yes
Sustainability policy	In Progress	Yes	Yes	Yes	Yes

Environmental Management System (EMS)

With the advent of the International Standards Organization (ISO) and the promulgation of ISO 9000 and ISO 14001, international seaports were early adopters of a systematic approach to operations and development. Many of the seaports reviewed had ISO 14001 certification and at

least one developed its own tool to support its internal management system efforts and to help others with the same.

For N.A. seaports, the extent and implementation of EMS vary. The majority of seaports utilizing an EMS limit its use to specific properties, operations, or programs - or what's commonly referred to as a "fence line EMS." This method appears to be most often used by seaports with numerous tenants and/or operations, allowing them to put the EMS in place for specific areas over which they have control and to exclude areas where they do not have control. Many of the seaports contacted indicated that by developing a fence line EMS, the procedures and environmental awareness that are established carry over into other operations not covered by the EMS.

While having an EMS is becoming more common at N.A. seaports, only a few have completed the ISO 14001 certification of their EMS. The recently opened Port of Houston's Barbours Cut Container Terminal was the first port facility in the U.S. to meet the ISO 14001 Standard. On the Columbia River system, only the Ports of Portland and Vancouver USA have Environmental Management Systems, and Vancouver's is limited to its well-head protection program, with no plans to expand the EMS into other areas at this time.

Smaller seaports interviewed stated that one barrier to implementing an EMS is the cost, staff time, and resources required. As a resource to seaports, the American Association of Port Authorities (AAPA) is encouraging and providing training for Environmental Management Systems. In 2004, AAPA began an EMS initiative involving the U.S. EPA, the Global Environmental & Technology Foundation (GETF), the U.S. Maritime Administration, the U.S. Army Corps of Engineers, and nine seaports around the country: Port of Houston, Virginia Port Authority, Port Authority of New York & New Jersey, Port of Portland, Port of Corpus Christi Authority, Port of Los Angeles, Port of New Orleans, Port Everglades, and Port of Vancouver USA.

Many of the international seaports researched are members of the EcoPorts Foundation (EPF), a nonprofit organization established in 1999 by a group of eight large European seaports for the benefit of ports and port communities. Through EcoPorts, member seaports can obtain a certification in proactive environmental management called the Port Environmental Review System (PERS). The PERS defines a basic standard of good practices for the port sector. As with ISO 14001 certification, an independent third party must perform the audit. In this case, an independent assessment of the PERS submissions is carried out by reviewers from Lloyd's Register B.V. (Rotterdam, The Netherlands). If the result of the review is positive, the EcoPorts Foundation Secretariat prepares a PERS Certificate. A list of seaports with PERS certification is found as Appendix B.

Several seaports interviewed are certified by the European Union's Eco-Management and Audit Scheme (EMAS). This voluntary instrument acknowledges organizations that improve their environmental performance on a continuous basis. EMAS differs from ISO 14001 by its government-legal origin. ISO 14001 has private legal origin that is recognized by the International Standardization Organization.

Environmental Management Systems	Port of Portland	Columbia River System Ports	West Coast	Gulf & East Coast	International (outside North America)
Port wide EMS program	Yes	No	No	No	Yes
"Fenceline" EMS program	N/A	Yes	Yes	Yes	Yes
ISO 14001 certification	No	No	Yes	Yes	Yes

APPENDIX A

1. What steps is the port taking in operations, planning and development to help reduce air emissions?

Replace	Older equipment with new more efficient models that comply to new emissions standards
Repower	Vehicles, equipment, and vessels with a significant amount of useful life left can often be re-powered with cleaner new engines, simply by swapping the old engine or a new one.
Retrofit	Older equipment can be retrofit with emissions controls and after treatment to reduce exhaust emissions.
Refuel	use of cleaner burning fuels such as LPG, CNG, ULSD, Biodiesel, emulsified diesel, etc. This may require a retrofit of the equipment.
Reduce Idling	Procedural and infrastructure changes that reduce the amount of time engines are idling, such as computerized entry and exit equipment.

2. How does your port address water management, conservation and discharge concerns including: stormwater management and ballast water treatment?

- Does your port have general stormwater permits for your facilities?
- Is your port part of a Municipal Separate Storm Sewer System (MS4) permit?
- Has your port installed any water quality infrastructure (swales, storm filters, cyclonic devices, planters, etc) aimed at improving stormwater runoff quality?
- Does your port have a water conservation program (building infrastructure, irrigation, etc.)
- Has your port implemented innovative water conversation or reuse processes using grey water or non-potable rain water groundwater?

3. What techniques does your port use to minimize the generation of waste and manage the waste that is generated?

- Reduce – Reuse - Recycle
    - Does your port have a program to reduce the use of materials?
    - Does your port have a program for reuse of materials either in house or through third parties?
    - Does your port have a recycling program? Which media is recycled (i.e. paper, wood, metal, etc.)?

4. What are some of the techniques used by your port to minimize the amount of energy used, i.e. energy conservation and renewable energy techniques?

- Does your port utilize any on site renewable energy sources (i.e. solar, wind, etc.)?
- Does your port purchase energy from green sources (solar, wind, etc) from your power provider?
- Does your port have an energy conservation program (i.e. light bulbs, automated lighting, insulating programs, etc.)?
- Has your port conducted energy audits of your facilities?

5. Please describe ways in which your port manages natural resources within its boundaries both in water as well as in the upland areas. This includes work done to mitigate for disturbed wetlands, bank stabilization projects, restoration of in water habitats, invasive species issues etc.

- Does your port have a mitigation program and how is it managed?
- Does your port have an invasive species program? Are you involved in local or statewide efforts?
- What does your port do with mature mitigation sites?
- Does your port manage any recreation facilities such as marinas and boat ramps?
- How do endangered species affect your operations, planning and development activities?
- Does your port have a riverbank/shoreline program?

6. Is your port currently utilizing any sustainable development practices in the development of new structures on its facilities?

- Examples of sustainable development practices may include the use of alternative electrical sources', solar etc, the use of green roofs or others.
- Has your port implemented any Low Impact Development (LID) standards in any recent projects?
- What is your definition of sustainability? Does your port have an official definition?

7. Please provide some examples of environmental practices that you feel should be used but are currently not being practiced.

- Examples include tenant programs.

8. Does your port utilize an EMS? If so how is it working?

- How are your objectives and targets developed? Who develops them? Who approves them?

9. Does your port perform dredging activities? Do you have a sediment management program?

- How often do you complete dredging activities?
- What is the process for obtaining appropriate authorization to dredge?
- Where do you place dredge material?

10. What are some examples of environmental programs that your port chose against implementing and why? Do you feel this was the right decision why or why not?

11. Has your port tried any environmental programs or procedures that you are no longer using? If so what were they and why were they abandoned?

APPENDIX B

List of Ports Certified under the Port Environmental Review System (PERS) Certification Program**

Dover Harbour Board, 2003 (1st) & 2006 (2nd), UK
Harwich Haven Authority, 2003 (1st) & 2006 (2nd), UK
Port of Tyne, 2003 (1st) & 2007 (2nd), UK
Aberdeen Harbour, 2003 (1st) & 2007 (2nd), UK
Port of Thessaloniki, 2003 (1st) & 2008 (2nd), Greece
Valencia Port Authority, 2003 (1st) & 2006 (2nd), Spain
Trieste Port Authority, 2004, Italy
Piraeus Port Authority, 2004, Greece
Port of Marseille Authority, 2005, France
Fowey Harbour Commissioners, 2005, UK
Associated British Ports Newport, 2005, UK
Associated British Ports Barry, 2005, UK
Associated British Ports Cardiff, 2005, UK
Associated British Ports Talbot, 2005, UK
Associated British Ports Swansea, 2005, UK
Havenschap Moerdijk, 2005 (1st) & 2008 (2nd), NL
Port of Amsterdam, 2005 (1st) & 2008 (2nd), NL
Port of Larne, 2005, UK
Groningen Seaports, 2005 (1st) & 2008 (2nd), NL
Port of London Authority, 2005, UK
Port of Cork, 2006 (1st) & 2008 (2nd), Ireland
Associated British Ports Southampton, 2006, UK
Associated British Ports Grimsby, 2006, UK
Associated British Ports Immingham, 2006, UK
Associated British Ports Hull, 2006, UK
Associated British Ports Goole, 2006, UK
Port of Felixstowe, 2006, UK
Castellón Port Authority, 2006, Spain
Port of Rotterdam, 2008, NL
Port of Dublin, 2008, Ireland
Port of Peterhead, 2008, UK
Killybeg Harbour Centre, 2008, Ireland
Port of Alicante, 2008, Spain

** As of October 2008
Source: ECOPORTS website http://www.ecoports.com/page.ocl?pageid=30

APPENDIX C

World Port Climate Initiative
List of Member Ports*

Africa

Port Autonome de Cotonou
http://www.portdecotonou.com

Port Autonome de Dakar
http://www.portdakar.sn

Kenya Ports Authority
http://www.kpa.co.ke

Ministry of Transport, Kenya
http://www.transport.go.ke

Lagos State Government
http://www.lagosstate.gov.ng/web/lagos/home

Transnet National Ports Authority, South Africa
http://www.transnet.net

Port Autonome d'Abidjan
http://www.paa-ci.org

Asia

Dubai Port Authority

Port of Hong Kong
http://www.mardep.gov.hk

Mundra Port & Special Economic Zone Ltd
http://www.mundraport.com

Jakarta Capital City
http://www.inaport1.co.id

Port of Kobe (Port and Urban Projects Bureau, City of Kobe)
http://www.city.kobe.jp/cityoffice/39/port/index_e.htm

Nagoya Port Authority
http://www.port-of-nagoya.jp/english/index.htm

Ministry of Transport & Communications, Oman
http://www.motc.gov.om/en

Seoul Metropolitan Government
http://english.seoul.go.kr

Maritime and Port Authority of Singapore
http://www.mpa.gov.sg

Sohar Industrial Port Company
http://www.portofsohar.com

Port Authority of Thailand
http://www.port.co.th

Bureau of Port and Harbor, Tokyo Metropolitan Government
http://www.kouwan.metro.tokyo.jp/english/index.html

Port of Yokohama
http://www.city.yokohama.jp/me/port/en

Australia/Oceania

Ports of Auckland ltd.
http://www.poal.co.nz

Port of Melbourne Corporation
http://www.portofmelbourne.com

Sydney Ports
http://www.sydneyports.com.au

Europe

Port of Amsterdam
http://www.portofamsterdam.nl

Port of Antwerp
http://www.portofantwerp.com

Port of Barcelona
http://www.portdebarcelona.es

Associated British Ports
http://www.abports.co.uk

Ports of Bremen/Bremerhaven
http://www.bremenports.de

Port of Cork Company
http://www.portofcork.ie

Dublin Port Company
http://www.dublinport.ie

Port of Dunkerque Authority
http://www.portdedunkerque.fr

Port of Gdansk Authority
http://www.portgdansk.pl/en

Port of Gothenburg
http://www.portgot.se

Hamburg Port Authority
http://www.hamburg-port-authority.de

Grand Port Maritime du Havre
http://www.havre-port.fr

Klaipeda State Seaport Authority
http://www.portofklaipeda.lt/en.php

Port of London Authority
http://www.pla.co.uk

Port of Marseille Authority
http://www.marseille-port.fr

Port of Moerdijk
http://www.havenschapmoerdijk.nl

Port of Oslo
http://www.oslohavn.no

Freeport of Riga Authority
http://www.freeportofriga.lv

Port of Rotterdam Authority
http://www.portofrotterdam.com

Ports of Stockholm
http://www.stoports.com

Port of Tallinn
http://www.portoftallinn.com

Port of Trelleborg
http://www.trelleborgshamn.se

Port Authority of Valencia
http://www.valenciaport.com

Zeeland Seaports
http://www.zeeland-seaports.com

Port Authority of Algeciras Bay
http://www.apba.es

North America

Port of Houston Authority
http://www.portofhouston.com

Port of Long Beach
http://www.polb.com

Port of Los Angeles
http://www.portoflosangeles.org

Montreal Port Authority
http://www.port-montreal.com

Port Authority of New York & New Jersey
http://www.panynj.gov

Port of Oakland
http://www.portofoakland.com

Port of Seattle
http://www.portseattle.org

South America

City of Buenos Aires

Port of Santos Port Authority
http://www.portodesantos.com

*Source: IAPH WPCI http://www.wpci.nl/about_us/members.php

APPENDIX D

Profiles of Ports Featured in this Summary

Port of Longview
http://www.portoflongview.com/

The Port of Longview is a full-service seaport in southwest Washington. The Port is located 66 river miles from the Pacific Ocean, 120 driving miles from Seattle, Washington, and 40 driving miles from Portland, Oregon. Port facilities include eight marine terminals and waterfront industrial property with direct connections to main-line rail and interstate highways. Cargo handling specialties include all types of bulk cargos and breakbulk commodities: steel, lumber, logs, pulp, paper, and project and heavy-lift cargo. In 2008, the port handled 1.3 million metric tons of inbound and outbound cargo.

Port of Kalama
http://www.portofkalama.com/

The Port of Kalama is located in southwest Washington on the Columbia River near Interstate 5. The port is 30 miles northwest of Portland, Oregon, and approximately 120 miles south of Seattle, Washington. The Port of Kalama's industrial area has seven miles of riverfront property adjacent to the 40-foot federally maintained deep draft navigation channel of the Columbia River. The port is served by the Burlington Northern/Santa Fe and Union Pacific railroads. The Port of Kalama is consistently ranked as one of the top five west coast ports for total volume of bulk commodity exported annually.

Port of St. Helens
http://www.portsh.org/

The Port of St. Helens has authority over a six mile-wide band that follows 51 miles of the Columbia River between Astoria and Portland, Oregon. At 1,300 acres, the Port consists of five industrial parks, a railroad corridor, a marine park, and an industrial airpark.

Port of Vancouver USA
http://www.portvanusa.com/
http://www.portvanusa.com/environmental-programs

The Port of Vancouver USA is a multi-purpose port authority located in Vancouver, Washington, along the banks of the Columbia River. Situated at the terminus of the Columbia River's deep draft channel, the Port has 13 deep-draft vessel berths and handles more than 500 ocean-going vessels each year. Annual total cargo volume exceeds five million metric tons. The port handles a broad range of cargoes, including general, breakbulk, project and direct transfer cargoes, containers, automobiles, forest products, steel and aluminum products, liquid bulks, and a number of dry bulk commodities such as bauxite, mineral ores, concentrates, fertilizers, sands, clays, grains and other bulk agricultural commodities.

Port of Portland
http://www.portofportland.com
http://www.portofportland.com/Env_Home.aspx

Located 100 miles upriver from the Pacific Ocean, Portland is the largest port in the state of Oregon. The Port is an 800-employee, 24/7 operation with more than $1.6 billion in marine and aviation transportation infrastructure and real estate assets that generates nearly $250 million in annual revenues. The Port's four marine terminals handle 14 million tons of cargo each year. The total value of waterborne trade for Portland imports and exports is more than $16 billion. The Portland Harbor exports the largest volume of wheat in the United States, and the Columbia River is the third largest grain exporting region in the world. The Port of Portland is the largest auto import gateway on the U.S. west coast. Additionally, the Port is the 16th largest container port in the United States and the 4th largest port on the West Coast for export tonnage. The Port also handles general breakbulk, mineral, and liquid bulk cargo.

Port of Pasco
http://www.portofpasco.org/

The Port of Pasco is the largest public marine terminal on the upper Columbia River; it handles barge shipments, bulk commodities, and containers. The area's geographic location makes it a hub for the Pacific Northwest, with access to several interstates and highways. Mainline railroad service is provided by Burlington Northern Santa Fe, which operates a major switchyard at Pasco. Air transportation, for both passengers and cargo, is available at the Tri-Cities Airport.

Port of Lewiston
http://www.portoflewiston.com

The Port of Lewiston, 465 miles from the Pacific Ocean, is the most inland port on the west coast. All major modes of transportation are available to Port shippers. The Port's location next to US Highway 12 allows a direct link to markets in Montana; the Port's proximity to US Highway 95 allows for links to Boise, Idaho. The Port also allows for links to US Interstate 84 to the south, and US Interstate 90 to the north. The Port of Lewiston provides the largest crane, warehouse facility, and grain storage facilities on the inland river system. Grain shipments are its largest export, and the Port maintains a combined storage capacity of 6.2 million bushels.

Port of Anchorage
http://www.portofanchorage.org/
http://www.portofanchorage.org/hi_environment.html?69,8

The Port of Alaska is a five-berth terminal in south-central Alaska, with facilities for containerized freight, bulk petroleum, and cement. More than four million tons of materials move across its docks each year. The Port serves 80 percent of Alaska's population and 90 percent of the consumer goods of Alaska. The Port is the major gateway for Alaska's water-

borne commerce. In terms of economic impact, the Port generates more than $750 million each year.

Port of Oakland
http://www.portofoakland.com/
http://www.portofoakland.com/environm/

Located on the mainland shore of San Francisco Bay, the Port of Oakland was among the first ports to specialize in intermodal container operations. Oakland's 20 deepwater berths and 35 container cranes (29 of which are post-Panamax size) are served by a network of local roads and interstate freeways, warehouses and intermodal railyards. Ten container terminals and two intermodal rail facilities serve the Oakland waterfront. The Union Pacific and BNSF railroad facilities are adjacent to the marine terminal area. The Port of Oakland loads and discharges more than 99 percent (approximately 2.2 million TEUs) of the containerized goods moving through northern California. Oakland's cargo volume makes it the fourth busiest container port in the United States and ranks San Francisco Bay among the three principal Pacific Coast gateways for U.S. containerized cargoes, along with San Pedro Bay in southern California and Puget Sound in the Pacific Northwest. Top cargoes include machinery, vehicles, foodstuffs, and apparel.

San Francisco Port Commission
http://www.sfgov.org/site/port_index.asp

The Port of San Francisco is a self revenue-generating agency of the City and County of San Francisco. The Port manages a broad range of maritime, commercial, and public-access facilities, which are held in public trust. Facilities include five berths, on-dock rail, cargo staging areas, over 550,000 square feet of covered storage for weather sensitive cargo, cranes capable of working both breakbulk and containers, and 624 reefer outlets. Several harbor and cargo service facilities are located near the terminals, offering efficient access to tug and barge companies, heavy lift crane services, a Foreign Trade Zone, cold storage, warehousing and CFS facilities, and full service ship repair. The Maritime Division manages 122 tenancies, representing six million square feet and approximately $11 million in annual revenue.

Port of Los Angeles
http://www.portoflosangeles.org/
http://www.portoflosangeles.org/idx_environment.asp

The Port of Los Angeles is located in San Pedro Bay, just 20 miles south of downtown Los Angeles. The seaport encompasses 7,500 acres, 43 miles of waterfront, and 27 cargo terminals, including dry and liquid bulk, container, breakbulk, automobile, and omni facilities. Combined, these terminals handle almost 190 million metric revenue tons of cargo annually. As the largest container port in the U.S., the Port set a new U.S. container volume record in 2006, with more than 8.5 million TEUs (twenty-foot equivalent units) recorded. With 26 major cargo terminals, including seven container facilities, the port is equipped to handle all types of international cargo. The Port is also home to the World Cruise Center passenger complex.

Port of San Diego
http://www.portofsandiego.org/
http://www.portofsandiego.org/environment.html

The Port of San Diego has more than 600 employees and had 2007 revenues of $133.7 million. Operating in San Diego Bay, the port is made up of Imperial Beach, National City, Chula Vista, San Diego, and Coronado waterfront properties. Principal inbound cargoes are refrigerated commodities, fertilizer, cement, breakbulk commodities, and forest products (including newsprint, cut paper, and cut sheet stock). Primary export cargoes include refrigerated cargo, breakbulk, and bulk commodities. The Port's National City terminal is among the top West Coast terminals for vehicles, lumber, and major project cargo.

Port of Houston
http://www.portofhouston.com/

The Port of Houston is a 25-mile-long complex of diversified public and private facilities located just a few hours sailing time from the Gulf of Mexico. These facilities handle general cargo, containers, grain and other dry bulk materials, project and heavy-lift cargo, and other types of cargo. The Port is ranked first in the United States in foreign waterborne tonnage and second in the U.S. in total tonnage. More than 225 million tons of cargo moved through the Port of Houston in 2007. A total of 8,053 vessel calls were recorded at the Port of Houston during 2008.

Each year, more than 7,700 vessels and 150,000 barges transport goods through the Port of Houston. More than 100 steamship lines offer service between Houston and over 1,000 ports around the world. Public facilities, which are owned and operated by the Port Authority, include 43 general cargo wharves available for public hire and two liquid-cargo wharves. These existing facilities offer shippers deep water access to world markets and a direct link to 14,000 miles (22,400 kilometers/12,180 nautical miles) of U.S. intracoastal and navigable inland waterways. A vast network of interstate highways and rail connections link Houston with inland markets; two major railroads and approximately 150 trucking lines connect the Port to the continental United States, Canada and Mexico. Air service is also easily accessible through two major public airports, Bush Intercontinental and Hobby, and dozens of private terminals.

Tampa Port Authority
http://www.tampaport.com/
http://www.tampaport.com/Port-Operations/Environmental

Tampa Port Authority is located at the western terminus of the Interstate 4 corridor, the fastest growing area of Florida, with more than eight million residents within 100 miles of the port. As the geographic center of the state, located halfway between Miami and Jacksonville, the Tampa region is an expanding distribution center gateway for the State of Florida and the southeast. Bulk cargoes are the Port's largest line of business and include liquid sulfur, anhydrous ammonia, petroleum products, phosphate, coal, aggregates, and cement. Tampa is also the energy conduit for central Florida, handling the gasoline and jet fuel needs of the region, with increasing volumes of ethanol moving through the port. Shipments of fertilizer and petroleum

products account for almost 75 percent of the total annual tonnage of cargo that passes through the port. Tampa's modern and efficient general cargo terminal facilities include one million square feet of warehouse and cold storage space, 80 acres of laydown area, and 8,500 feet of dock length.

Port Authority of New York and New Jersey
http://www.panynj.gov/
http://www.panynj.gov/DoingBusinessWith/seaport/html/environmental_commit.html

The Port of New York/New Jersey is the largest port complex on the east coast of North America and is located at the hub of the most concentrated and affluent consumer market in the world, with immediate access to the most extensive interstate highway and rail networks in the region. In addition, The Port Authority directly oversees the operation of seven cargo terminals in the New York/New Jersey region; the Port also provides rail and trucking services. The Port has been the grantee for FTZ No. 49 since 1979. The Port Authority of New York and New Jersey builds, operates, and maintains infrastructure critical to the New York/New Jersey region's trade and transportation network. These facilities include America's busiest airport system, marine terminals and ports, the PATH rail transit system, six tunnels and bridges between New York and New Jersey, the Port Authority Bus Terminal in Manhattan, and The World Trade Center site.

MassPort
http://www.massport.com

The Massachusetts Port Authority is New England's gateway to the world. By air, MassPort operates Boston Logan International Airport, with a record 28.1 million passengers served in 2007. Approximately 50 airlines provide Logan's passengers with more than 100 nonstop domestic and international destinations. More than one million tons of cargo each year are shipped by sea through MassPort's terminals in the Port of Boston. The Port of Boston's container division handles more than 1.3 million tons of general cargo, 1.5 million tons of non-fuels bulk cargo, and 12.8 million tons of bulk fuel cargo yearly. Massport's Black Falcon Cruise Terminal serves luxury cruise lines. By land, Massport also runs the Tobin Memorial Bridge, which is the link to Boston for 36,000 commuters each day.

Port of Baltimore
http://www.marylandports.com/
http://pob.mpa.state.md.us/

The Port of Baltimore is located in Chesapeake Bay. It has a 50' channel, is the closest east coast port to the Midwest, and is accessible to 50 percent of the nation's population within an overnight drive. The Port of Baltimore handles over 30 million tons of cargo annually. It ranks among U.S. leaders in roll-on/roll-off cargo, imported forest products, automobile exports, overall tonnage handled and total cargo value.

Port Everglades
http://www.porteverglades.org/

Port Everglades is located on the southeastern coast of the Florida peninsula within the three cities of Fort Lauderdale, Hollywood, and Dania Beach, and unincorporated Broward County. It is approximately 23 miles north of Miami, 48 miles south of West Palm Beach, and 312 miles south of Jacksonville. Port Everglades has annual operating revenues of more than $66 million and total waterborne commerce exceeding 23 million tons in liquid, bulk and containerized cargoes. More than 5,300 ships call at Port Everglades in a year, with maritime operation that include a thriving cruise industry and a reputation as the "world's best cruise port," a growing containerized cargo business, a major petroleum storage and distribution hub, South Florida's primary bulk cargo depot, and a U.S. Navy liberty port.

Port of Morrow
http://www.portofmorrow.com/index.htm

Located on the Columbia River near Boardman, Oregon, the Port of Morrow offers industrial building sites from 1 to 2,000 acres in size as an alternative to metropolitan areas. Three industrial parks—served by efficient transportation modes—make the port an alternative for many industries. Building on the region's role as a prominent food processing center, the port is also home to fiber and seed processing industries, lumber processing, and transportation facilities.

Port of Umatilla
http://www.portofumatilla.com/

Located on the Columbia River, the Port of Umatilla is "Oregon's Inland Port." The Port District encompasses 12 municipalities within a 3,200 square mile jurisdiction. The facilities are near two interstate highways and a major railroad switch yard. The Port of Umatilla features three terminals for handling containerized and bulk cargo: a full service container on barge operation, grain loading facility, and petroleum distribution complex.

Port Metro Vancouver
http://www.portmetrovancouver.com/
http://www.portmetrovancouver.com/environment.aspx

Port Metro Vancouver is Canada's largest and busiest port. Positioned on the southwest coast of British Columbia in Canada, the Port jurisdiction covers nearly 600 kilometers of shoreline and extends from Point Roberts at the Canada/U.S. border through Burrard Inlet to Port Moody and Indian Arm, and from the mouth of the Fraser River, eastward to the Fraser Valley, and north along the Pitt River to Pitt Lake; it also includes the north and middle arms of the Fraser River. As the fourth largest tonnage port in North America, the Port has 28 major marine cargo terminals and connects to three Class 1 railroads. The Port's deep-sea terminals include super post-Panamax capacity and on-dock rail facilities. PMV's freshwater facilities offer integrated services for the automobile and coastal forest industries and for short-sea shipping. Port Metro

Vancouver serves as homeport for the Vancouver-Alaska cruise industry. The Port handles nearly 130 million tons of cargo each year. The top commodities are coal, forest products, chemicals, metals, and minerals. Almost 95 percent of the Port's total volume serves Canadian import and export markets.

Port of Seattle
http://www.portseattle.org/
http://www.portseattle.org/community/

The Port of Seattle, located on Elliot Bay in Washington's Puget Sound, includes four container terminals, 24 cranes (7 super post-Panamax cranes and 14 post-Panamax cranes), a natural deep-water harbor, and 11 container berths up to 50 feet (15 meters) deep. The Port of Seattle has facilities to handle a variety of general and project cargo, including more than 233 acres of space and 8,000 feet of moorage. The Port of Seattle was the ninth largest U.S. port in 2008 in terms of TEUs, approximately 1.7 million. The Port of Seattle is within one mile of two major rail hubs, which connect it to four railroad routes to inland markets, and within five minutes of two major interstate highways for efficient truck access. The Port also owns and operates Seattle-Tacoma International Airport.

Port of Tacoma
http://www.portoftacoma.com/
http://www.portoftacoma.com/Page.aspx?nid=5

A major gateway to Asia and Alaska, located on Commencement Bay in Washington's Puget Sound, the Port of Tacoma handled more than $36 billion in annual trade and nearly two million TEUs in 2008. The Port is the seventh largest container port in North America. It's also a major center for bulk, breakbulk, project and heavy-lift cargoes, and automobiles and medium-duty trucks. The Port's top exports are grain, meat, iron, and steel. Top imports include electronics, industrial machinery, and vehicles and auto parts. The Port has numerous intermodal connections, including access to two transcontinental railroads and Interstate 5, Interstate 90, and major state highways. More than 70 percent of the Port's international import container cargo travels east via rail to major markets such as Chicago, Indianapolis, New York, and Boston.

Port of Long Beach
http://www.polb.com/
http://www.polb.com/environment/

Trade valued annually at more than $100 billion moves through Long Beach, California, making it the second-busiest seaport in the United States. Everything from clothing and shoes to toys, furniture, and consumer electronics arrives at the port before being shipped to locations throughout the country. Specialized terminals also move petroleum, automobiles, cement, lumber, steel, and other products. The Port of Long Beach is the second-busiest seaport in the United States and a key transportation hub in the global trade marketplace. East Asian trade accounts for about 90 percent of the shipments through the port. The port's top trading partners are China, South Korea, Hong Kong, and Japan.

Port of Canaveral
http://www.portcanaveral.com/index2.php
http://www.portcanaveral.com/general/environment.php

Port of Canaveral is located along the center of the eastern Florida coast. Its facilities include nine cargo berths, two liquid bulk facilities, intermodal gates, a roll-on/roll-off ramp, and dry-freight, open-air, and freezer/chill storage. The port is also a Foreign Trade Zone. The Port is linked to key markets by land, sea, and air routes – four airports within an hour's drive and Interstate 95, the eastern seaboard's main north-south corridor, is only 13 miles away. The Port's annual total cargo tonnage is over four million short tons. Bulk (cement, petroleum, aggregate, and salt) and breakbulk cargo (lumber, frozen concentrate and single strength juice, newsprint, perishables, steel, and white cement) are the staples of the port's business.

Port of New Orleans
http://www.portno.com/
http://www.portno.com/pno_pages/citizen_ems.htm

The Port of New Orleans is at the center of the world's busiest port complex – Louisiana's lower Mississippi River. Its proximity to the American Midwest via a 14,500-mile inland waterway system, six Class One railroads, and the interstate highway system makes New Orleans a major gateway for the movement of cargoes such as steel, rubber, coffee, containers, and manufactured goods. The Port of New Orleans is a diverse general cargo port, handling containerized cargo such as apparel, food products, and consumer merchandise. The Port's general cargo volume has averaged 8.6 million tons from 2003 through 2007.

Port of Charleston
http://www.port-of-charleston.com/

The Port of Charleston, the state port authority, handled 1.7 million TEUs in 2009, and Charleston breakbulk cargo totaled 660,096 tons. Top commodities across Charleston docks include agricultural products, consumer goods, machinery, metals, vehicles, chemicals and clay products.

Prince Rupert Port Authority
http://www.rupertport.com/

Prince Rupert, located on the northwestern Canadian coast, has the deepest natural harbor in North America. The entrance into the inner harbor ranges in depth between 34-44 meters. Depths at existing berths range between five and 20 meters. One of the largest transcontinental railways and a major transcontinental highway connect the Port of Prince Rupert to the rest of North America. Prince Rupert is Canadian National (CN) railway's link into the North American continent. CN fits the definition of US class 1 Railway and is the only transcontinental railway in North America. CN has wide-ranging links into the US mid-west, and its reach extends into Mexico. The Trans-Canada links Prince Rupert to the rest of North America and the Alaska

Highway links it northward. The Port handles 10.5 million MT of cargo annually. Cargoes include grain, coal, logs, and other general containerized cargo.

Port of Corpus Christi
http://www.portofcorpuschristi.com/
http://www.portofcorpuschristi.com/Environmental.html

The Port of Corpus Christi is mid-way along the Texas coast on the Gulf of Mexico (approximately 150 miles north of the United States/Mexico border). It is also a Foreign Trade Zone. The Port's terminals handle heavy lift, roll-on/roll-off, breakbulk, containerized and other types of general cargo and refrigerated cargo. The Port handles over 87 million ST of cargo yearly. Its main cargoes are petroleum products, grain, and other dry bulk.

Port of Everett
http://www.portofeverett.com
http://www.portofeverett.com/home/index.asp?page=37

The Port of Everett is situated on Port Gardner Bay at the mouth of the Snohomish River. It is located 25 miles north of Seattle on the Puget Sound. The Port operates eight berths situated on approximately 100 acres of land, a bulk unloading facility, and multi-purpose warehouse. The Port is served by the Burlington Northern and Santa Fe Railroad. Located one day closer to Asian markets than California facilities, the Port of Everett handles a wide variety of cargoes including, but not limited to, aerospace parts for the local industry, heavy machinery, construction equipment, project cargo, bulk commodities, and containerized commodities.

Associated British Ports, United Kingdom
http://www.abports.co.uk

The UK's leading ports group, Associated British Ports (ABP), owns and operates 21 ports around the UK and handles approximately a quarter of the country's seaborne trade. Its ports are: Ayr, Barrow, Barry, Cardiff, Fleetwood, Garston, Goole, Grimsby, Hull, Immingham, Ipswich, King's Lynn, Lowestoft, Newport, Plymouth, Port Talbot, Silloth, Southampton, Swansea, Teignmouth and Troon.

ABP also has a property division which is responsible for managing the Group's extensive land and property assets. Issues relating to land that are used for port operations may involve anything from managing tenancy agreements to renegotiating leases, or providing expert advice on property-related matters when a disposal or acquisition is being considered. In addition, ABP's property division negotiates and manages the disposal of land and property that has been

identified as non-core to the ongoing ports and transport business, adding value by securing alternative planning consents and infrastructure where appropriate.

Hong Kong Container Terminal Operators Association Limited, Hong Kong, China
http://www.hkctoa.com/intro.html

The HKCTOA was established in 1999 by the container terminal operators of Kwai Tsing Port of Hong Kong. Its mission is to promote the Port of Hong Kong as the key container hub port of the region providing premier service to the container shipping industry.

Currently there are nine container terminals in the Kwai Tsing Port. All terminals are financed, built, owned and operated by five private operators. The largest of the five ranks as the biggest independent container terminal operator in the world. In 2006, the Kwai Tsing container terminals handled over 16 million TEUs, roughly about two-thirds of the total throughput of the Hong Kong port and recorded a 12 percent growth when compared with the terminal throughput of 14.28 million TEUs in year 2005.

Kenya Ports Authority, Mombasa, Kenya
http://www.kpa.co.ke/content.asp?cat=SAFETY

The Port of Mombasa is the second largest port in Africa in terms of tonnage and containers handled after Durban. Total cargo traffic through the port averages 14 million tons a year. After Durban, Mombasa is the best connected port in the region, with 17 shipping lines calling and direct connectivity to over 80 ports. Mombasa serves the hinterland markets of Kenya, Uganda, Rwanda, Burundi, Eastern Democratic Republic of Congo, Northern Tanzania, Southern Sudan, and Ethiopia.

Mombasa is located on the east coast roughly midway between the South African port of Durban and major ports in the Red Sea and Middle East. Since it was first developed in the time of British colonial rule back in the late 19th century, the Port of Mombasa has provided a main gateway for Kenya's international trade. Today, Mombasa handles about 13 million tons of cargo each year, including 3 million tons for transit cargo. The Port is equipped to handle a wide range of cargoes including: dry bulks such as grain, fertilizers, cement and soda ash; liquid bulks such as crude oil and oil products; as well as bagged products (coffee, tea, sugar, etc.), breakbulks (iron and steel, timber), motor vehicles, machinery, and containerized cargo.

Marine Department, Hong Kong Special Administrative Region, Hong Kong, China
http://www.mardep.gov.hk/en/home.html

The Kwai Chung and Tsing Yi Container Terminals, located in the northwestern part of the harbor, have nine container terminals with 24 berths of about 7,694 meters of deep water frontage. It covers a total terminal area of about 279 hectares which includes container yards and container freight stations. The nine container terminals have a total handling capacity of over 19 million TEUs which will help maintain Hong Kong as the premier port for Southern China. Hong Kong handled 24.5 million TEUs (20-foot equivalent units) in 2008, making it one of the world's busiest container ports. Of the total container throughput, some 17.7 million TEUs were

handled at Kwai Chung and Tsing Yi Container Terminals, while about 6.8 million TEUs were handled in mid-stream and other wharves.

Namibian Ports Authority, Namibia
http://www.namport.com

Namport, operating as the National Port Authority in Namibia since 1994, manages both the Port of Walvis Bay and the Port of Lüderitz in Namibia. The Port of Walvis Bay is situated at the west Coast of Africa and provides an easier and much faster transit route between Southern Africa, Europe and the Americas. The Port of Lüderitz, located to the Southern Coast of Namibia caters for Southern Namibia as well as providing access to markets in the Northern Cape of South Africa. Namibian Ports Authority also manages a Syncrolift (dry dock facility), where vessels up to 2,000 tons can be lifted for repairs.

Ports of Auckland, New Zealand
http://www.poal.co.nz/

The Ports of Auckland provides a full range of cargo-handling and logistics services at two seaports – one on the east coast adjacent to the Auckland central business district, the other on the west coast in Onehunga – and a strategically located inland port at Wiri, South Auckland. By value of trade handled, the Port is New Zealand's most significant port, handling 50 percent of all imports and 24 percent of exports. Overall, it handles 35 percent of New Zealand's total annual trade by value – the equivalent of 13 percent of the annual GDP.

The Ports of Auckland operate in three locations in the Auckland region – New Zealand's economic hub. The Auckland seaport is New Zealand's largest container port, handling more than 840,000 20-foot equivalent container units (TEU) per annum. Total container volumes represent 48 percent of the North Island container trade and 36 percent of New Zealand's total container trade. The general wharves handle 3.6 million tons of bulk and breakbulk (non-containerized) cargo each year, including more than three-quarters of all vehicles imported into New Zealand. The Ports of Auckland provide towage, pilotage and linesman services on the Waitemata and Manukau Harbors, where it services upwards of 1,700 ship calls – an average of five ships each day of the year.

Port of Brisbane, Australia
http://www.portbris.com.au/sustainability

The Port of Brisbane is Queensland's largest general cargo port, and Australia's fastest-growing container port. Managed by the Port of Brisbane Corporation, the main port complex is located at the mouth of the Brisbane River, and is the only purpose-built, capital-city, intermodal port complex in Australia. The Port's limits extend geographically from Calendar to the southern tip of Moreton Island, including the 90km shipping channel, which is dredged to a minimum of 15m LAT (Lowest Astronomical Tide). Port facilities extend upriver for about 15km and include bulk commodity and general cargo wharves, a cruise terminal, and a dockyard facility. Each year over 2,600 ships exchange over 30 million tons of cargo over the port's wharves. This activity currently generates a total annual contribution to the Queensland economy of $1.9 billion.

Port of Cork, Ireland

http://www.portofcork.ie

The Port of Cork is the key sea port in the south of Ireland and the State's second largest port in revenue terms. It is also one of only two Irish ports facilitating all five shipping modes (Lift-on-Lift-off, Roll-on-Roll-off, Liquid Bulk, Dry Bulk and Break Bulk). Continuous private sector and European Union investment in state-of-the-art facilities has equipped the port to handle the widest possible range of cargo and traffic. The 2007 Port of Cork performance reinforces Cork's position as the premier port on the south coast of Ireland. In 2007 traffic again exceeded 10 million tons for the third year in a row and at 10.6 million tons achieved the highest annual throughput in the history of the Port of Cork. Turnover for the year amounted to €24.9 million and profit on ordinary activities, before taxation amounted to a record €6.4 million.

Port facilities and operations are situated at four distinct locations (City Quays, Tivoli Industrial and Dock Estate, Ringaskiddy Deepwater and Ferry Terminals, and Cobh Cruise Liner Terminal). The Port of Cork provides and facilitates port activities and services including channel dredging; pilotage; towage; stevedoring; lift on/lift off; roll on/roll off; cruisers; liquid bulk; dry bulk; land and property rental. City Quays handle approximately 1 million tons of cargo at present. The majority of the remaining cargo is handled downriver at Tivoli Industrial and Dock Estate and Ringaskiddy Deepwater Berth. The Port of Cork has 104 full time employees and operates a 7 days a week, 24 hour operation.

Port of Dublin, Ireland
http://www.dublinport.ie

Dublin Port Company is a self-financing, private limited company wholly-owned by the State, whose business is to manage Ireland's premier port, the Port of Dublin. Established as a corporate entity in 1997, Dublin Port Company is responsible for the management, control, operation and development of the Port. Dublin Port Company provides world-class facilities, services, accommodation and lands in the harbor for ships, goods and passengers. The company currently employs 161 staff.

Located in the heart of Dublin City, at the hub of the national road and rail network, Dublin Port is a key strategic access point for Ireland and in particular the Dublin area. Dublin Port handles over two-thirds of containerized trade to and from Ireland and 50 percent of all Ireland's imports and exports, making it a significant facilitator of Ireland's economy. Dublin Port also handles over 1.3 million tourists through the ferry companies and cruise vessels.

Port of Göteborg, Sweden
http://www.portgot.se/

Port of Göteborg, owned by the City of Göteborg, acts as both Port Authority and stevedoring company. It is by far the largest port in the Nordic region and in recent years has also reinforced its position as a transit hub for the Baltic region and Russia. The Port of Göteborg is also the only

port in the Nordic region with deep-sea calls to all parts of the world. Last year, the Port of Göteborg handled 43.3 million tons of freight. The Container Terminal, which is the largest in the Nordic region, last year handled 862,500 TEUs. Twenty-four rail shuttles with daily departures allow easy access to the rest of Sweden and the Nordic region via Göteborg. The Port of Göteborg is also the largest Swedish port of entry of export vehicles in Sweden. Last year, 271,500 vehicles were either exported or imported through Göteborg .From the port's roll-on/roll-off terminal (the second-largest in Sweden). There is regularly scheduled traffic to other countries in northern Europe. The Port's other operations comprise cruise ships, ferry traffic, and oil.

Port of Helsinki, Finland
http://www.portofhelsinki.fi/english/

The Port of Helsinki is the main port for international trade and the busiest passenger port in Finland. It caters to the Finnish business and recreational communities, with multi-modal transportation options. Port services are provided by private companies. The Port of Helsinki operates in the city of Vuosaari, and Vuosaari Harbor is the center of container and roll-on/roll-off traffic (e.g. trucks and trailers). Passenger traffic is mostly concentrated in the South Harbor and the West Harbor.

Port of Le Havre, *Port Autonome du Havre*, France
http://www.havre-port.fr

The Port of Le Havre consists of a series of canal-like docks that connect Le Havre to the Seine, close to the Pont de Tancarville, 24 km (14.9 m) upstream. The Port of Le Havre is France's largest in terms of traffic and second largest in terms of tonnage. It is the largest container port in France with 2.1 million TEU in 2005; 60 percent of France's container traffic and 40 percent of all oil entering France is transported via La Havre. Le Havre is the fifth busiest port in Europe. Energy ranks first, with importations of crude oil and coal, and transfer of refined products and gaseous hydrocarbons. Main bulk goods are grains, industrial products and chemicals. The number of commerce ships landing each year in Le Havre is about 7,000, involving 250 scheduled lines with more than 500 ports all over the world. The Port has developed specialized terminals and recently developed a new port for container ships, the largest in France and one of the largest in Europe.

Port of Montreal, Canada
http://www.port-montreal.com

Montreal is one of the busiest inland ports in the world and a key transfer point for transatlantic cargo. Along with its port, the metropolis has railway and highway networks leading to all parts of North America. Montreal is also one of the main cruise attractions on the St. Lawrence River and the North American East Coast. Linked to more than 100 countries around the world by numerous shipping lines, the Port of Montreal is located on the St. Lawrence River. It offers the shortest route between major European and Mediterranean ports and North American markets. Situated 1,600 kilometers inland from the Atlantic, it is the international port closest to North America's industrial heartland, representing a hinterland of some 100 million Canadian and

American consumers. Every year, the Port of Montreal handles more than 20 million tons of highly-diversified cargo: containerized and non-containerized general cargo, grain and other dry bulk, and petroleum and other liquid bulk products. Its export and import container traffic is such that it fosters economies of scale, allowing shipping lines to offer regular, high-frequency services, which are attractive to companies requiring just-in-time delivery.

Port of Rotterdam, Netherlands
http://www.portofrotterdam.com

The Port of Rotterdam has an annual throughput of more than 400 million tons of goods, and more than 500 scheduled liner services connect Rotterdam with over 1,000 ports worldwide. The Port is directly situated on the North Sea; the very largest ocean-going vessels can access the port unrestricted 24 hours a day, seven days a week. The port and industrial area stretches over a length of 40 kilometers and covers 10,000 hectares. Rotterdam is Europe's cheapest bunker port. The European market is accessible from Rotterdam via five competing modalities: road, rail, inland shipping, coastal shipping, and pipeline. One of the main advantages of Rotterdam is its location on the estuary of the rivers Rhine and Maas. As a result, efficient and economical transport by inland vessel is possible deep into the heart of Europe.

Sydney Ports Corporation, Australia
http://www.sydneyports.com.au

Sydney hosts the second largest container port in Australia, serving the nation's largest market. The Port of Sydney handles more than $50 billion of international and domestic trade annually. Trade through the ports consists of predominantly imported containerized trade, bringing commodities such as manufactures and household consumables to Sydney and New South Wales (NSW). Other port cargo includes containerized exports, non-containerized trade such as bulk goods and liquids, cars, and cruise vessels. The expansion at Port Botany will accommodate projected increases in Sydney's containerized trade for the next two decades and beyond. By 2024–2025, the port expansion will have generated 9,000 new jobs; over the next fifteen years, this expansion is estimated to inject $16 billion into the NSW economy.

Port of Tokyo, Japan
http://www.kouwan.metro.tokyo.jp/english/portoftokyo2008/index.html

Port of Tokyo is one of the largest Japanese seaports and one of the largest seaports in the Pacific Ocean basin, with an annual traffic capacity of around 100 million tons of cargo and 4.5 million TEUs. The Port is also an important employer in the area; more than 30,000 employees provide services to more than 32,000 ships every year. In 2007, the Port of Tokyo handled 90.8 million tons of cargo and 3.69 million TEUs, making it one of the busiest cargo ports in Japan and one of the largest container ports in the country. The port is located in the area between the estuaries of the Arakawa and Tamagawa Rivers.

Shanghai International Port Group – Terminal Operator Shanghai, China

http://www.portshanghai.com.cn/en/index.html

Port of Shanghai is situated at the middle of the 18,000 km-long Chinese coastline, where the Yangtze River, known as "the Golden Waterway," flows into the sea. It is the leading port in the T-shaped waterway network composed by the Yangtze River and the coastline, and is also China's largest comprehensive port and one of the country's most important gateways for foreign trade. The annual import and export trade through Shanghai, in terms of value, accounts for a quarter of China's total foreign trade. The Port's container throughput in 2006 reached 21.71 million TEUs, ranking it the third largest container port in the world for three years running. Container liner services from the Port of Shanghai cover all major ports around the world. More than 2,000 container ships depart from the Port every month, en route to North America, Europe, the Mediterranean, Persian Gulf, Red Sea, Black Sea, Africa, Australia, Southeast Asia, Northeast Asia, and other regions.