COMMODITY FLOW FORECAST UPDATE AND LOWER COLUMBIA RIVER CARGO FORECAST

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LOWER COLUMBIA RIVER MARINE CARGO FORECAST

TASK REPORT – TASK 4 LOW-HIGH FORECAST FINAL REPORT

For:

PORT OF PORTLAND

METRO

OREGON DEPARTMENT OF TRANSPORTATION

PORT OF VANCOUVER

REGIONAL TRANSPORTATION COUNCIL

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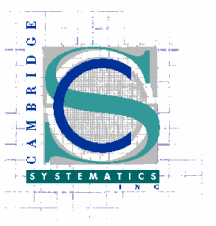

July 8, 2002

Lower Columbia River Marine Cargo Forecast
Task 4 – Low-High Forecast

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INTRODUCTION AND SUMMARY OF FORECASTS

This section presents a summary of the macroeconomic forecasts impacting the Lower Columbia River's trading partners and a summary of projected forecasts by direction of trade.

MACROECONOMIC FACTORS

Underlying the freight flows of commodities that are shipped internationally is not only the outlook for the U.S., Oregon, Washington, and the Portland metropolitan region but also the forecasts for the performance of the economies of U.S. trade partners. The background on the economic outlook for these trade partner countries and regions is presented below, with an emphasis on economic conditions that can affect their trade with the United States.

The U.S. and the world went through recession in 2001 after strong U.S. growth throughout most of the 1990s and into 2000. The economies of many major U.S. trade partners had less steady growth during this period. Asia, and especially Japan, had a much more difficult time during the last half of the previous decade, with an economic downturn that earned the name "the Asian crisis" in 1997 and 1998, and two recessions in Japan during the decade even before the 2001 recession.

The long term economic and trade outlook is influenced by the structural, political and demographic shifts occurring in the economies of U.S. trade partners, with Trans-Pacific trade so important to Portland being most heavily affected by the rapid development of China and the continued economic problems in Japan.

Exchange Rates

One of the key factors affecting the level of trade at any point in time is the relative currency exchange rate between the U.S. dollar and the currencies of its trade partners.

For several years, the United States has had an exchange rate policy that has not attempted to reduce the strength of the U.S. dollar. The reasons for the sustained recent strength of the dollar are many, but fundamentally were tied to the willingness and the desire on the part of foreigners to invest in the United States and to hold U.S. currency.

From the perspective of the U.S. dollar demand from abroad, much of it can be described as foreigners making investment in capacity and industrial production in the country.

The result of this strong U.S. dollar had made purchases of imports relatively cheaper for the U.S. while U.S. exports have been made less price competitive on world markets. The impacts within the U.S. of a strong dollar are not evenly distributed across sectors of industry, the population and the geography of the country. Export-dominated industries and areas, such as in the U.S. Pacific Northwest, suffer from lower export sales and the resulting slowdowns in production and employment. Industries depending on imported materials as inputs to their own production benefit from the lower dollar prices of imported goods. For example, low dollar-priced foreign electronic and communications equipment benefit those companies and individuals that purchase these imports due to lower expenditures and potentially higher productivity from the ability to afford the foreign-made equipment.

Looking back over the last decade, the dollar reached record highs year after year. The robust expansion up until 2001 drew funds to the U.S. from around the world. The buildup of the current account deficit indicated that America's obligations to foreign economies have risen to a very high level. Not only has the U.S. economy faced huge outflows of interest payments overseas, the large current account deficit also foretells problems now that foreign investors are reducing their appetite for investments in the United States.

The problems that came with a strong dollar are now starting to diminish, now that the dollar exchange rate has begun to soften. It has taken a long time for the weakening of the dollar to begin, considering that the U.S. economy dipped into recession in 2001. The U.S. Treasury has not encouraged foreign investors into leaving the dollar. Indeed, with the United States' strong position in the global economy, investors worldwide seemed to expect that it the U.S. would have a sustained edge over foreign economies, regardless of good times or bad times.

The recent drop in the U.S. Dollar-Yen and U.S. Dollar-Peso exchange rates may see some reversal in the near-term, but the long term fundamentals still point to a reduction in the U.S. dollar exchange rate, as trade imbalances and consequential import financing demands exhaust the rest of the world's willingness to support them. The U.S. dollar exchange rate with the Japanese yen may be limited in its fall due to the hesitancy of the Japanese government in hindering their exports due to a stronger currency in the face of their own country's recession.

With the U.S. economy serving as the global recovery engine out of the 2001 recession, the forecast is for the U.S. dollar exchange rate to fall over the long term. The Canadian dollar, yen, euro, and British pound will all strengthen against the dollar in 2002, as foreign investors begin to question the invincibility of corporate America. Ironically, those doubts will help export businesses in America, which has seen exports slide as a result of the dollar's strength. This will benefit U.S. exports of goods, such as in agriculture, where the U.S. still has substantial production capacity. However, even a decline of 20% in the dollar (back to the levels of the early 1990s) would not to turn U.S. goods exports into a substantial growth engine, because so much manufacturing production has been moved offshore in the interim.

World Country and Region Macroeconomic Outlook

Canada

Canada - U.S. trade is the largest between any two countries in the world. Following the North American Free Trade Agreement, the economies of the two countries are linked more closely than ever, with many companies following production and distribution plans that treat these countries as one market. Due to the link between the economies, Canada also suffered an economic downturn during 2001. However, the Canadian economy suffered only one quarter of negative growth in 2001. Their recovery is starting strongly in 2002, with annual gross domestic product forecast to be a bit above to 3%.

Over the next ten years Canada is well positioned for economic growth of about 3% with modest inflation. Canada's economic prospects are very strong relative to other countries with the exception of the United States. Canada is well positioned to compete in the "knowledge-based economy" with low inflation and a reduced tax structure by 2005.

Canada will continue to have opportunities to lower unemployment and improve training and job mobility, though the forecast is not for aggressive policies to reduce the high level of structural unemployment, particularly in eastern Canada. There are good opportunities for energy development off both coasts. A major long-term risk to Canada's growth would be appreciation of the Canadian dollar relative to the U.S. dollar because Canada's current level of exports to the U.S. are due partly to the competitiveness of producing in Canada for the U.S. market.

Over the longer term, Canada will still be well positioned for non-inflationary economic growth, with low unemployment, and a low debt burden. The standard-of-living gap between Canada and the United States will likely widen further, but at rates less than in the past decade. This gap is primarily due to the fact that Canada's technology sector is neither as large, as complete, nor as productive as that in the U.S. This is also a major reason why the long-term sustainable growth rate for Canada has not risen as much as it has in the United States. Canada's population growth rate has also slowed, and fallen behind that of the United States. Over the longer term, Canada's strong economic and fiscal performance, particularly its strong trade position, especially when accounting for the large U.S. trade deficit over the longer term, will move the Canadian dollar upward.

Japan

For most of the last twenty years, Japan was the second largest U.S. trading partner country after Canada. Recently however, due to the economic problems in Japan, and the success of the North American Free Trade Agreement in increasing U.S. – Mexican trade, Japan has fallen to third place behind Mexico. Nevertheless, Japan is still the most significant overseas U.S. trade partner in the world. The outlook for Japan as a U.S. trade partner country is not strong, when compared with faster growing Asian economies, especially China. The primary reasons for this are Japan's continued problems with the structural and regulatory aspects of their own economy. The forecast is not all negative however. Japan is expected to gradually recover from its current slump. Japanese exports and their trade surplus are forecast to increase later in 2002. There has been a permanent structural change in Japan that has permanently increased import penetration into Japan, making a return to the large trade balances in previous years very unlikely. The manufacturing of goods consumed in the domestic Japanese market to mainland Asia, especially China. The boost from external demand in the form of increased Japanese exports will help end the 2002 slide.

Further moderate economic restructuring is expected for Japan, and it will improve the performance of the financial sector. Japan's continual monetary stimulus will eventually feed into the general economy as well. The impacts will be tempered by increases in bankruptcies and unemployment, which, coupled with Japan's relatively inflexible labor and capital markets, will keep the economy slow until almost 2005. The gross domestic product growth over this time will average less than 2%. Structural improvements should begin to have a positive impact around 2004-06, as market forces necessitate bankruptcies and bad-loan write-offs, while normal attrition will gradually shrink the excess employment in Japan's construction and manufacturing sectors. As the financial sector returns to normal functioning, the high level of liquidity generated by the Bank of Japan should begin to feed through into the wider economy and yield further stimulus. Thus, GDP growth rates are

forecasted to rise above 2% before 2010. These trends are all positives for the yen, which should follow a course of gradual appreciation against the U.S. dollar.

Longer term, a key issue for the Japanese economy will be the aging of its population. With a low birth rate, high longevity, and a relatively early retirement age, transfer payments by the government to the elderly will become extremely burdensome during the next decade. Allowing or even encouraging increased immigration could alleviate this problem, but Japanese policymakers have shown little interest in this option. Thus it is an open question whether or not the government will deal openly with this problem, by adjusting spending and taxes, or will ignore it and fund the imbalance via deficit spending.

China

After Japan, China is becoming perhaps the most important Pacific Rim trade partner for the U.S. This is not so much from the size of the Chinese economy or the current volume of trade, but the fact that China has been growing rapidly as a U.S. trade partner, especially as a source for U.S. imports of manufactured goods. The potential for further growth in trade is significant, as the Chinese economic development has been rapid in recent years, driven partly by large foreign investment in China. China is the one economy in Asia that was least affected by the "Asian crisis" recession of 1997 –1998, with sustained growth in gross domestic product of over seven percent annually.

China's economic conditions are forecast to remain positive in the near term. Export performance should continue to be strong, aided by global demand recovery. The Chinese government has engaged in deficit spending, partly to build needed infrastructure, which will also help boost growth in 2002. During the period 2002-2007, China will pursue economic structural reforms to address increasing foreign competition resulting from their entry into the World Trade Organization (WTO). These reforms will result in increased unemployment, which will dampen domestic demand growth. There is also a risk of social unrest. If these negative effects persist, economic growth could be much slower than in recent years, as the government is unlikely to continue the massive infrastructure spending to support growth indefinitely.

In the long term, the pace of China's long-term growth depends on how successfully the government is in reforming the country's massive and inefficient state companies and their banking system that is plagued by bad loans. With WTO membership, the government is taking on the pursuit of these reforms aggressively. These reforms will also transform the Chinese economy into one that is more market oriented and, ultimately, more efficient.

Aside from these structural problems, China possesses some very favorable factors for long-term growth. The country has an extremely high saving rate, at around 40%, which makes aggressive capital accumulation possible. China has also become very successful in attracting foreign investment, especially from the developed Chinese economies of Taiwan and Hong Kong, which facilitates technology transfer. In addition, WTO membership will further increase the country's openness to trade. As a result, the forecast is for the productivity gains following reform will be substantial, though less than the initial market opening gains achieved after Deng Xiaoping's reforms in 1978.

South Korea

South Korea was able to avoid recession in 2001 though their exports sent exports down 20% at one point, and consequently lowered industrial production for the year. Korean auto exports have remained strong and, because they are more labor-intensive than high-tech goods, have kept manufacturing employment relatively steady. Korean domestic demand - especially retail sales and construction - has grown at a fast pace, offsetting the loss of exports. Korea will see a return of export growth during 2002, leading to a GDP growth rate of over 5%. In 2003-2004, with the industrial sector responding to increased export demand, GDP growth is forecast to climb to just over 6%. The forecast is for domestic demand to moderate somewhat, as consumers catch up for the unusually low spending of the post-Asia crisis years, and as higher housing prices cool the real estate market. Inflation will accelerate, but will be limited to the 4–6% range due to central bank rate hikes and excess capacity in manufacturing.

In the long term, with relatively high educational attainment, South Korea's attractiveness to foreign investors, and progress in high-tech industries, will enable the country to sustain growth rates in the 4–6% range through 2010. Much of this growth will be internally generated, with the external balance declining as a percentage of South Korean GDP; it is even possible that Korea could see a return to trade deficits, if capital inflows are high enough to appreciate the won significantly. Few new problems are expected from the large conglomerates (chaebol) that caused so much trouble during the late 1990s. The previous mistakes of the chaebol - incurring excessive debt to fund inefficient expansion - are unlikely to be repeated, and under the government's leadership, they will continue to become more market-oriented. Korean banks as well were chastened by the Asia crisis, and will have clearer accounting and more realistic loan valuations in the future. Lastly, though the population growth rate will decrease over time, current demographic trends do not indicate as rapid aging of the citizenry as will be found in Japan in the future, thus Korea should avoid the problems associated with social spending imbalances. Long-run unemployment will remain low, averaging around 3%; however, the unemployment rate is forecasted to gradually rise, as Korea shifts to a service-based economy with a greater structural mismatch between job requirements and workers' skills during the transition. This structural shift will affect the goods trade of Korea with fewer low value manufactured goods production for export and a greater percentage of imported goods as a share of domestic goods consumption.

Hong Kong

Between 2002 and 2010, Hong Kong's economy will move beyond the recovery from its 2001 economic slowdown. During this period, improving global demand, following the revival in the U.S. and world economies, will continue to boost the territory's total exports and, in turn, its export-oriented economy. In addition, China's strong growth is likely to benefit Hong Kong's economy as well. Meanwhile, the property market and overall prices will rebound along with the economic recovery. Also, the government will reduce the current large fiscal deficit and balance the budget. Moreover, through its healthy financial system, the territory has served as the gateway to China, which is likely to continue and provide some help to Hong Kong's economy, after China's accession to the World Trade Organization.

Growth in Hong Kong over the long run is unlikely to repeat its superior performance in past decades. The economy has already matured, with annual per capita GDP well above $20,000. Nevertheless, the territory has several favorable characteristics for its long-term outlook: openness to trade, a high saving rate, a government with a long history of noninterventionist policy, and a massive and fast-growing economy next door - China. There are also factors that will limit Hong Kong's prospect for growth. In particular, fast-rising wages and real estate prices have deteriorated Hong Kong's competitiveness. The currency board system that pegs the Hong Kong dollar to the U.S. dollar not only makes Hong Kong vulnerable to mismatches between its business cycle and the U.S. monetary policy, but also creates inflexibility in its business-costs adjustment. Moreover, as China's major cities develop, Hong Kong needs to address the likely loss of its unique status as the main trade gateway into China, which has been crucial to the territory's economic success since China opened up in the late 1970s.

Singapore

Singapore's economy was hurt by the global recession in 2001 with lingering impacts into 2002. Singapore's GDP fell 1.9% in 2001, compared with strong 10.2% expansion in 2000, but is forecast to recover in 2002, to 3% growth. Singapore will continue to experience relatively strong growth through 2010, as both the global economy and domestic technology sector return to growth. While it is unlikely that Singapore will get back to the rates of growth achieved during the expansion of the 1990s, the forecast is for annual GDP growth to average almost five percent the rest of the decade. Domestic savings will average slightly above 43% in this period, lower than the 1997-2001 average of 49%, as Singaporeans increase their rate of consumption. Investment will also recover, although at a slower rate than private consumption. In spite of the improvement in growth, employment will not return to its pre-recession level. The jobless rate should average 4.4% annually by 2010.

Singapore's long-term economic outlook remains positive. A move toward expanding the financial-services industry and the announcement that the industry will be deregulated should encourage a renewal of foreign investment in Singapore. Although the government is likely to move slowly, these changes will significantly improve the country's long-term prospects. Singapore's aggressive moves to achieve free-trade agreements with its trading partners, most recently the United States and New Zealand, should also ensure strong export growth in the next decade. Exports will continue to be important for Singapore's growth, but domestic demand will most likely become more relevant to long-term growth. Singapore has good infrastructure and a highly educated work force. A risk to the forecast and sustained long-term growth, however, is the outflow of skilled labor. However, the forecast assumes the government will attempt to reverse this trend by allowing more freedom and encouraging innovation. The government is stable and has always followed prudent economic policy. The chance of sharply reduced growth in the long term remains low.

Taiwan

Now in recovery after a three-quarter downturn in 2001, Taiwan will enjoy favorable long-term growth. The country's manufacturing sector has successfully been transformed from a low value-added producer, e.g., textiles and toys, into a high valued-added one, e.g., electronics and computers. Taiwan's persistently high saving rate will allow the country to

continue investing aggressively. There is some risk that Taiwan could suffer as Japan has, from shifts in domestic investment to mainland China, reducing domestic employment and consumption. However, the openness of the Taiwan economy and strong links to China will prevent it from falling to the same fate. The forecast is for the population's high level of education and increasing research and development efforts will sustain productivity growth. Another positive factor is the island's openness to trade, which will be bolstered further by entry into the World Trade Organization. The island's resources, however, have been highly concentrated in the high-tech industries and export sectors. The distortion of resources and the government's policies will likely restrain the island's further economic transformation and development. In addition, Taiwan's continued concentration on export sectors will make it difficult for the island to avoid being pulled into any global cyclical slowdown by its trade partners.

Thailand

Following a continued slowdown in 2001, Thailand's economy began to recover by year-end. Higher private domestic consumption, boosted by continued spending on government stimulus funds and loosened monetary policy, was the main factor behind the return to economic growth. The government has spent heavily on village development funds, pubic projects, and other emergency stimulus measures to promote the return to growth in the last year. Increasing rural income and a rebounding local stock market, coupled with lower interest rates have led to higher domestic demand for durable goods, which led to higher consumer spending and a boost to the economy. Domestic investment is lagging along with still low industrial capacity utilization. Additionally, due to the global slowdowns, Thailand's exports have not recovered yet, which has slowed the economic recovery, as exports account for some 62% of real GDP at the end of 2001. The forecast is for exports to pick up later in 2002, following the recovery in the U.S and global economies, yet in the longer term, increasing competition from China will limit the extent of Thailand's export recovery. Meanwhile, as public debt has soared, so the government will have little room for further fiscal expansion in support of the economy. On top of that, restructuring of non-performing loans by the Thai Asset Management Corporation has slowed and led to still high bad loans in the financial system, which also dampens the revival in the economic growth. As a result, although rebounding, the economy is unlikely to show a strong recovery during 2002, with solid growth not expected until 2003, as exports accelerate with stronger global demand.

The ongoing reforms in Thailand's financial system, as well as a structural reform to counter the increasing external competition, remains the main constraint to the rate of Thailand's further development. Additionally, the government's progress in privatization of state enterprises will benefit the economy during this and subsequent decades.

The long-term outlook for Thailand's economy remains positive, but is dependent on the continuation of reform, especially the restructuring of the financial sector. A stronger and more transparent banking sector will improve the domestic investment profile and ensure continued growth. Thailand has substantial modern infrastructure and a large labor pool, which is forecast to continue to attract foreign firms and investors. Also, in the long term, Thailand will continue to attract long-term foreign direct investment (FDI) from companies keen to position themselves not only for the country's domestic growth potential, but also

for its role as a gateway to the Asian market, although it will continue to face strong competition from China. Thailand's long-term position will likely be limited by the degree to which China successfully reforms and advances the development of its own financial system.

Malaysia

Malaysia was affected by the global recession during 2001 with GDP for the year growing only 0.4%, with GDP decreasing at an average annual rate of 0.9% year during the last have of 2001. Starting in 2002, Malaysian output has returned to moderate growth, most of the growth has come from government consumption, while private consumption also has started to increase as well. While the economy is still sluggish, the decline in the economy has bottomed out. Entering 2002, industrial production was still falling after rapid declines toward the end of 2001. Manufacturing output has also continued to decline, though is expected to recover later in 2002. Both exports and imports also slowed sharply at the end of 2001, although the outlook is now improving. The value of Malaysian exports fell by 10.2% in 2001, but have started to increase in 2002, the first increase since early in 2001. Meanwhile, imports fell by 10.1% in 2001 and a return to growth is slow so far in 2002. The forecast is for Malaysia's economic output to grow 3.1% in 2002. Inflation has stayed relatively subdued, averaging just 1.4% in 2001 and is expected to average 1.6% in 2002. Following a 5% decline in 2001, producer prices started to increase slowly again in 2002, the first increase since 2000. Interest rates have also remained low.

Malaysia will continue to enjoy relatively strong growth through 2010. While it is unlikely that the country will go back to the strong growth levels of the 1990s, the forecast is for growth to average almost 5 percent annually during this period. Domestic savings will average a bit above 41% through 2010, slightly lower than the average during the later part of the 1990s, as Malaysian consumers increase their rate of consumption. Investment will also recover somewhat and average 2.6% growth over this time. The current account surplus is projected to decline, as imports start to grow faster, but the current account will remain in surplus through 2010.

The forecast for Malaysia in the long-term remains positive, yet it is highly dependent on the continuation of the reforms in the financial sector, as well as stable capital-market policies. A strong and transparent financial sector will improve the domestic investment profile and ensure continued growth. In the long term, Malaysia's ability to continue its impressive growth of the 1980s and 1990s assumes it will ease labor constraints and reduce discriminatory policies that favor Malays over other minority ethnic groups.

Malaysia has strong infrastructure, as well as an educated labor pool, which will continue to attract foreign investment. There will still be vulnerability to political disruptions, however, as long as the current government lasts. As a consequence of the draconian capital constraints imposed during the Asian crisis in 1998, Malaysian leader Mahathir is still seen as a loose cannon whose statements and policies can discourage foreign investment. Still, given his domination of Malaysian politics, a succession of struggles after his departure could generate a leadership vacuum and instability for a few years.

Indonesia

Indonesia has the largest population of any Southeast Asian country and has the single biggest economy in the region. And benefiting from having the world's fourth-largest population and an endowment of energy resources, Indonesia's economy developed rapidly in the 1980s and into the mid-1990s. Unfortunately Indonesia was severely impacted by the Asian economic crisis in 1997-1998, with massive disruption to its economy and effects that lingered into the global recession of 2001. Recovery has begun in 2002, with projected economic growth at around 3.2%. Yet slow consumer and investment spending in the context of still-soft external demand will hamper the rate of growth of the economy. Private and public consumption are recovering and will grow at a modest pace through the rest of 2002. New price hikes, rising unemployment, and declines in overseas worker remittances will constrain consumer spending growth in the remainder of 2002. This economic recovery has begun even with consumer confidence, as measured by the consumer confidence index (CCI) in broadly negative territory. Government spending will continue to extend some support to economic growth, although to a lesser degree than in 2001, when public consumption rose a massive 8.2%.

Gross fixed investment is expected to be flat and could even contract in 2002, as the bounce-back from the dramatic declines witnessed after the Asian crisis has now run its course. Investment outlays contracted in 2001, and the forecast is for the retrenchment to continue through 2002. Waning Foreign Direct Investment approvals and recent falls in capital goods imports reinforce this view of investment. Although nominal interest rates should start to come down later in 2002, the projected slowdown in inflation means that borrowing costs will remain high in real terms.

In the long-term, the global recovery is forecast to lift export demand, while high world oil prices will increase export revenues. Domestically, political stability and debt relief can lift business and consumer confidence, laying the foundation for the recovery in investment after the decline in 2001. These forces should then set the stage for much stronger growth in 2003, when the economy is expected to expand by 5.0%.

Assuming the structural reforms are adopted, foreign investment will revive and the domestic economy will stabilize. Indonesia is forecast to achieve 5% average annual economic growth by 2003 and sustain this throughout the decade. Ongoing efforts towards decentralization are expected to result in persistent fiscal deficits in this decade, as the newly empowered provinces engage in fiscal expansion. The private sector will likely lag behind, as lingering effects from price and political instability (the 2004 election is already on the horizon) weaken consumer confidence and preclude robust near term gains. Long-term growth rates could be even higher, however, depending on Indonesia's ability to attract additional foreign investment. Ever since the Asian crisis ended the previous direct investment flows of the mid-1990s, it is difficult to imagine that foreign investment inflows will recover entirely any in the future. The heightened political risks and legislative uncertainty following the end of Suharto's rule will deter some investors, particularly if Islamic militancy, ethnic violence, or pro-independence movements in the provinces become widespread.

Indonesia's shaky transition to democracy, after more than three decades of authoritarian rule, has an important role in determining the country's long-term potential for growth.

Nevertheless, Indonesia is on the verge of fundamental change; indeed, a number of structural changes are being set in motion that will have significant long-term economic impact. For example, the distribution of power between the central government and the provinces could eventually be re-drawn in ways that have deep-seated fiscal and distributive implications.

The country is rich in natural wealth and has significant, albeit declining, deposits of oil and gas, mineral, and agricultural resources. With its large population, Malaysia has abundant labor supply. An increasingly outward orientation and export diversification during the 1980s and early 1990s ushered in above-average growth, which is what enabled Indonesia to become the single biggest economy in dynamic Southeast Asia. Its ability to retain openness in trade, deregulate its markets, engender savings growth, and provide a suitable environment for technology transfer and investment will determine its future pace of advancement.

Philippines

The Philippines' near-term economic outlook has improved considerably since 2001. The forecast for 2002-2003 is for industry and agriculture to both see modest gains, and a recovering U.S. economy will boost Philippine electronics exports, one of the key drivers to the economy. Coupled with better-than-expected growth of 3.4% in 2001, 2002 growth is also projected to reach 3.6%.

Restored political stability combined with aggressive monetary policy has supported economic growth in the Philippines. This loosening monetary trend, improving demand conditions, and stable political environment will bolster investor sentiment in the 2002-2003 period.

The Philippine economy is expected to register annual gains averaging 5% in this decade. Achieving this higher rate requires sustaining growth in the agricultural sector, a recovery in industrial exports, and an improvement in the level of (and environment for) investment. The forecast is that the Philippine economy will reap the returns from ongoing economic and fiscal reform efforts. Investment is expected to increase to 18-19% of GDP by 2007. Improvement of physical infrastructure is crucial to raise investment in the economy. The uncertain outlook for ongoing privatization efforts increases the difficulty of estimating when the Philippines achieve their deficit targets. Progress in the privatization program will foster higher growth and investment, increases revenues in the near term, and reduces expenditure demands on the government. As 2001's cyclical global slowdown recedes, greater Philippine exports and remittance inflows will propel the Philippines back towards higher trend growth.

Long-term prospects for the Philippine economy are generally bright; substantial economic reforms undertaken in the 1990s position the country on a path of sustainable expansion. The strong consensus required for fiscal and structural reform in this open democracy supports stability on policies. Robust growth, however, is contingent on increasing domestic savings and investment from their currently low levels. The country's saving rate is less than 20% of GDP, lower than that of other Asian countries, in part because of weak capital markets. A high dependency ratio (the birth rate is greater than 2%) and weak capital markets diminish the prospects for a sizable increase in the saving rate. Under-investment in rural regions, agriculture, and human capital, together with a stymied land-reform program

has led to poverty and inequality. These structural weaknesses constrain the long-term growth outlook.

India

A rebound from last year's manufacturing slowdown will raise growth in India's economy in 2002 to about 5.5%. Although industrial production has slowed from the strong increase of 7.4% in 2000, the recovery is forecast for 2002 with 2.4% growth forecast for industrial growth. Gains in Indian software exports will bolster the recovery. There is also a strong recovery in the agricultural sector, which still accounts for nearly one-quarter of India's economy.

Inflation is not an issue in India now, as consumer prices have remained relatively low. Slowed economic growth and stable consumer price inflation propelled the central bank to lower interest rates starting in 2001. The outlook for further near-term interest rate cuts remains poor, however, due to the looming fiscal deficit. Although the current budget restructures the tax system, boosts privatization, and lowers borrowing, the reform budget is unlikely to be radical enough to revive growth and lure back foreign investors. Inflows of portfolio investment and rising foreign-exchange reserves are likely to continue.

India's long-term growth prospects depend critically on efforts made by the government to deregulate a broad swathe of the economy and rid it of burdensome regulations stemming from the "license raj." The ability to control the country's nettlesome fiscal deficit will be key in reducing the high cost of capital for the country's private sector. Rapid urbanization rates will act as an important force of change in the long term. India's transformation from a largely autarkic state towards a progressively greater outward orientation will raise the contribution to GDP from net exports, although the pace of change will be gradual and nowhere near the rates that are forecast for East Asian countries.

Russia

Russian economic performance will be solid, but more modest in 2002 in the wake of the global economic slowdown and the squeeze on energy sector profits in early 2002. The Russian economy demonstrated resilience in 2001 despite the global downturn. A number of key producing sectors displayed relatively strong economic momentum in 2001. It is assumed that the worldwide economic slowdown will continue to transition towards a full rebound, led by the rapid turnaround in U.S. economic activity already in evidence at the end of the first quarter of 2002. The quickening pace of growth in industrialized countries, together with supply management by both OPEC and non-OPEC oil producers and a high degree of political uncertainty in the Middle East, will result in higher oil prices and recovering profitability in Russia's energy sector. Continued progress in legislating market reforms and improving the business and investment environment, including a renewed emphasis on the rule of law, will take place. Together with steady but moderate progress in bringing down inflation rates, Russia will become more attractive to investors, both domestic and foreign, going forward.

Industry and trade are the two largest industry sector contributors to Russian GDP and will be chiefly responsible for the modest decline in growth of aggregate gross valued added in 2002, and will restrain the rate of expansion in the next five years, along with incomplete reform and restructuring in several key areas, such as banking and natural monopolies.

Russian industry will face increasing competitive challenges both at home and abroad, as the currency continues to strengthen and the costs of energy and transport are adjusted upward toward cost-recovery levels. More modest gains in real wages and tighter fiscal constraints will slow growth of consumption and, hence, the trade sector. Other market services, including transport and communications services, will also reflect the slower growth in industry and the trade sector. The forecast for GDP growth is to slow modestly, to 3.8% in 2002, then rebound to 4.2% in 2003. GDP growth is forecast to slow more significantly in 2004, to 2.9%, due to the impact on the real sector of an anticipated bail out of the state-owned commercial banking sector. We project GDP growth to reaccelerate in 2005-06 to 4.1-4.2%

The pace of growth in Russian output is forecast to continue to moderate over the long term, as the gains in productivity most readily obtained from reform and restructuring will have been achieved already. Russia will remain primarily an exporter of energy and other raw and processed material inputs to industry, while its manufacturing sector will continue to depend largely on the domestic market and some key export markets in the CIS countries. Even in the formerly captive markets of the CIS, though, consumers and enterprises alike will prefer more sophisticated goods from the industrialized West and Southeast Asia, especially as the strengthening of their currencies over time in real effective terms makes these higher-quality imports more affordable. Thus, we project Russian GDP growth at 4.1% annually in 2006-10, moderating to 3.3% in 2011-15 and further to 2.8-2.9% to 2025.

Australia

Among all developed country economies in 2001, Australia best escaped the broad global recession with economic growth sustained during 2001. This achievement was more remarkable with declines in exports due to the decelerating world demand due to the slowdown in the United States, Europe, and Japan, and the resulting weakness in the rest of Asia. It was domestic demand that helped boost Australian economic growth in 2001, with overall growth reaching 2.4% in 2001, following 3.2% growth in 2000. The forecast is for the economy to improve in 2002, growing at 2.9%. Because of continued positive signs from the domestic economy and a moderate 2.9% inflation rate in the first quarter of the year.

Australia will continue to enjoy relatively strong growth during the long term. The domestic economy will take a gradually less cyclical lead, with a rising contribution from net trade as the rest of the world's economy continues to expand. Unemployment should average close to 6.5%, about its structural level, with slowing employment coming in line with increases in the Australian labor force. Domestic savings will average a bit above 21% in this decade, in line with the average in the last part of the 1990s. The current account deficit will also begin to abate, and will average around 2.9% of GDP over the longer term.

New Zealand

New Zealand has begun to see recovery following 2001 when annual growth in the economy was 2.8%. The increase in interest rates in 2002 has led to a strengthening currency, with the New Zealand dollar now at its highest level since mid-2000. The domestic economy is showing signs of rebounding, as business and consumer confidence surges. Investment expectations, particularly in business, still are lagging the recovery in 2002 owing to the slow pace of recovery of economic activity in much of the rest of the world, which places

further pressure on investment. Gross domestic product growth will pick up to 2.8% in 2002.

Over the long term, the New Zealand economy is forecast to achieve growth at rates above the average growth compared with the last decade. Unemployment will continue to fall as economic activity expands, with steady employment advances outstripping slowing labor-force growth. While the currency will most likely regain some of its value, the current account deficit should begin to improve over the period to 2010. The deficit may not be eliminated completely, but it should return to the more sustainable level it held before the 1997 Asian crisis.

Europe

Following the recession in 2001, Western Europe's outlook has stabilized and recovery is getting underway. The region's overall GDP is forecast to grow modestly in 2002, after stagnating for most of 2001, where regional GDP was up only 0.5% at an annual rate at the end of 2001. The forecast for Western Europe's average annual GDP growth is 1.5% growth in 2002, but the annual figure masks a substantial acceleration in the second half of the 2002. The forecast projects regional GDP growth will approach 3.0% at an annual rate by the end of 2002. The recovery will be led by exports, but it should also get a big boost from rebuilding of inventory levels, which were reduced sharply during 2001.

The major obstacles to a more robust recovery are the cautious policies of the monetary and fiscal authorities in most of Western Europe, but particularly in the countries, which have adopted the common Euro currency, and the expectation of a slower rebound in the rest of the world. Furthermore, the strength of the recovery will be dampened by high unemployment and high world oil prices.

Europe's economic growth could potentially outpace that of the United States over the next five years because its economy suffers from fewer macroeconomic imbalances than the U.S. economy. The forecast projects Western Europe's average annual GDP growth to be 3.1% in 2003 and 2.7% in 2004. Thereafter, the pace is projected to gently approach the region's trend growth rate of less than 2.5%. However, the U.S. economy's structural superiority is forecast to return to its long-term trend growth rate (which is at least 0.5% per year above Europe's). Also, Europe's fiscal and monetary policy are now limited by their own multi-country growth and stability pact. In fact, European economies have become so dependent on the U.S. since the Asian crisis of 1997-1998 that Europe would probably slow down in line with the U.S. economy in case U.S. imbalances became a major problem during the next decade.

Europe's long-term growth prospects are constrained somewhat by structural rigidities of its markets, burdensome social-welfare programs, and demographic factors. The forecast projects trend growth rate for Western European GDP at less than 2.5%, compared with the average annual rate of about 2.0% experienced during the 1990s.

While significant structural improvements have occurred in many of the region's economies, much more will have to be done if the region as a whole is to achieve sustained, high growth in line with that of the United States. The areas that could benefit most from major reform include the Europe's over-regulated and inefficient labor markets, costly social security

programs, large state subsidies and protection of politically sensitive sectors, and immigration and political asylum policies.

According to the European Central Bank (ECB), there is no clear evidence that the growth potential of the countries with the common currency the Euro (which accounts for 70% of the region's GDP) has increased as a result of technological improvements or "new economy" developments. The ECB believes these countries' trend growth rate is 2.0-2.5%, because it has not yet achieved the level of U.S. advances in productivity.

As with Japan, a serious long-term problem facing Western Europe is the rapid aging of its population, which will put its labor markets and pension systems under increasing stress during the next several decades. The IMF has estimated that by 2050, both Germany and France will have as many pensioners as workers. With no change in their pension systems, it would take more than 40% of the two country's wage bill to keep them solvent. Despite efforts to increase the workforce through immigration and increases in the retirement age, countries such as Germany, France, Italy, and Spain will probably be hit hard by the demographic shifts in the long term, with the United Kingdom and Ireland less affected. Without measures to counter the emerging pension problem, the European Union's per-capita GDP would fall by about 19% by 2050. On average, EU citizens now retire at 58 compared with the statutory retirement age of 65.

Latin America

The global recession hit Latin America hard in 2001, with return to growth not assured for 2002. Due to political trouble in Argentina and Venezuela, there has been considerable disruption to the economies of the region, affecting trade and foreign direct investment. The region will benefit from higher world economic growth in 2002, but the return to growth in these economies will ultimately depend on the developments on the political landscape and their effects on capital flows. If capital flows continue to dry up, the region will likely continue to show weak economic growth for the next few years, which will further reduce opportunities for output and productivity gains for the long term. The political arena is controlling the agenda in Latin America, which reduces the influence of business in achieving potential economic growth. Meanwhile, the Mexican economy is still depending on U.S. economic growth to pull it out of its 2001 recession. There are serious concerns, however, that the maquiladora industry's "splendid" growth years are a thing of the past. The reason for this below-par recovery performance is the consistent increase in maquiladora workers' real wages, which is making the Mexican industry less competitive than those of other countries, such as China, even with the difference in transportation costs to serve the U.S. market.

For the long term, Latin American countries are now facing one of the toughest periods in their history. After a decade of progress, reforms are faltering, and all the countries are slowing the pace of reform. The region is experiencing a backlash from the decade of reforms in the 1990s that transformed the economic relationships in these economies and between the economies and the political system. But while the economies have been transformed and modernized, the political systems are still reminiscent of times gone by. All the political clientelism and the nepotism that characterized these countries remain in place. The only difference now is that fewer of the economic resources are still in the hands of the political system to abuse. Now, politicians have to negotiate and deal with rational

consumers and businesses that resent the political system's intervention in their affairs. In some countries, such as Venezuela, this backlash has already produced the resurgence of populist governments. Other countries could share this fate, if economic conditions continue to deteriorate or do not improve considerably. The two probable exceptions to this are Chile and Mexico.

There are important differences between these two countries, however. Chile is one of the most stable countries in Latin America, with only one episode of political instability in its recent history. Economic and social policy is rational, and the country has a high degree of institutionalization of its political, social, and economic structures. Mexico, meanwhile, has much greater proximity to the United States than the rest of Latin America, and is a member in the North American Free Trade Agreement (NAFTA). The NAFTA membership has been a strong stabilizing force in the Mexican political environment. While there is no guarantee that this force will be a permanent feature, so far "membership has its privileges" and the Mexican economy is a good example of the benefits of being part of a larger community of countries. It is still not clear, however, how the political system will react if the PRI wins the next presidential elections, or how the political system would evolve. Nevertheless, the medium to long-term prospects remain positive for the Mexican economy, tied ever more closely to the U.S. economy.

Middle East and Africa

Long-term prospects for growth in the countries of the Middle East and Africa are not bright, particularly when compared with the countries of emerging Asia. Among the reasons for lack of acceleration in growth are expectations of decline in real long-term oil and other commodity prices over the next decade; the high degree of vulnerability to commodity price shocks and other external events; and the low level of the region's attractiveness to foreign investment. According to the forecast, real oil prices in 2010 will be lower than the 2000 level. Given expected demand conditions and forecasts of an increase in non-OPEC oil supply, output from Middle Eastern oil exporters will have to decline to maintain oil prices above $20 per barrel.

Although non-oil exports will fare relatively better, recovery in the prices of those commodities will be lackluster, particularly coming from very low levels. For countries of the region that signed the recent EURO-MED trade agreement, market penetration for agricultural commodities will be constrained by the remaining restrictions in the early phase of the agreement. Economic growth in the Middle East and Africa will average 4.4% in the long term.

Eastern and Central Europe

The long-term growth forecasts for Eastern and Central Europe assumes that all countries in the region will continue to record average annual rates of economic growth in excess of those expected for the developed economies. Only in this way will the substantial income gap be narrowed more rapidly than in the past. Among these countries, three groups of economies will find themselves in slightly different economic environments in the long term. By 2005, eight of the Central European countries will become members of the EU and, most likely, by 2008-09 most of them will adopt the Euro currency, putting the European Central Bank in charge of their monetary policy. Growth in these countries, both pre- and post-accession, should exceed that recorded for the more developed EU economies,

as evidenced by past examples of other accession countries such as Spain, Greece, and Portugal. The forecast, however, is that following the initial period of compliance with the Maastricht inflation-target criteria; consumer price inflation will rise rapidly in all of those countries. As shown by the recent acceleration in inflation in the Czech Republic, as soon as solid growth resumes, consumer price inflation surges. The increase is driven by sizable increases in nominal wages made possible by rapid gains in export sectors. These increases spill over into price pressures in household services, government, and other sectors serving the domestic economy. These increases in nominal wages are the means by which the transition economies will narrow the Euro income gap with Western Europe and cannot be artificially stopped without choking economic growth.

The second group of countries includes the less developed economies of the Balkans. While omitted in the first round of accession, these countries are cleaning up their markets and are creating better business environments in order to attract foreign direct investment and restructure their economies. Once the leading economies in the region become EU members, the interest of the international investors will shift towards the low-cost economies of the Balkans, providing a strong stimulus to growth.

Finally, the economies of the former Soviet republics are also likely to enjoy strong growth in the long term. While many of them will remain commodity providers, countries such as Russia, Ukraine, Belarus, and Kazakhstan are likely to benefit strongly from economic integration with the rest of the world and from WTO membership. The annual growth rates will stay above levels recorded by more developed economies. Following an initial period of adjustments in administratively controlled prices to cost recovery levels, inflation will moderate in the high single digits. These countries will remain vulnerable to changes in international prices for key fuels and commodities.

Overview of the U.S. Economy and Forecast Assumptions

Because the detailed commodity flow forecasts depend on the DRI•WEFA U.S. macroeconomic and U.S. regional forecasts, a summary of the key underlying assumptions and drivers are discussed here. It should also be noted that the study was undertaken in the midst of an economic downturn, in a post-9/11 environment. Short-term effects on passenger and freight transportation were clearly adverse. The cyclical response of the U.S. economy and the disruptive influences of terrorism are reflected in the short-run paths of key macroeconomic variables, notably real GDP and employment. The DRI•WEFA national economic forecast the decline in real GDP just for the fourth quarter of 2001, making for a short and muted recession.

The story of 2001 was one of collapsing investment and inventory liquidation even before 9/11. Business investment fell in the United States and overseas. As the effects of the U.S. slowdown were felt abroad, trade replaced investment as the weakest sector in the short term. Since a rebound is starting in the U.S. before our trading partners' economies, imports are rising in advance of any recovery in exports. Only late in 2002 with a lower dollar and a gathering foreign recovery, will there be a significant upturn in exports.

Between falling investment and sluggish consumer spending, manufacturing activity also fell in 2001. The protracted decline in factory output – falling in most months in the last two years – is the steepest since the 1982 recession. Inventories have been shrunk from February 2001 through the end of the year, though the rebuild began during the first half of

2002. During this period production will need to be stepped up, even to meet a sluggish order flow.

The federal government has given the recovery a boost. Although the ramp-up in spending took some time, the fiscal 2002 budget contains a huge amount of fiscal stimulus. The impact of this stimulus on the long-term forecast is slight. The measures adopted supported spending in the short term, but have not done much to speed the actual recovery. The real stimulus is in the tax cuts and the increased spending on education, security, defense, and intelligence.

State and local governments would like to be part of the cure for the ailing economy, but major revenue shortfalls are severely limiting their ability to help. To make matters worse, escalating demands for additional security at public facilities and expanded monitoring of public health are forcing difficult budget choices. Most states accumulated some reserves during the recent boom, but these are rapidly depleting. Public construction continues apace, though, as governments struggle to keep up with infrastructure needs and environmental requirements.

The U.S. Federal Reserve is still pushing liquidity into the monetary system. At 1.75%, the federal funds rate target has reached the lowest level in 40 years, while the real rate is zero or even negative, depending on which price index one uses. The Fed has stopped lowering rates and now is under watch for increases to fight any threat of inflation with recovery. Long-term rates have already begun to rise in anticipation of recovery, a return to federal deficits, and higher inflation.

The forecast assumes that the federal funds rate will be held down for the first half of 2002 but there is a concern that higher federal deficits and inflation could prompt the Fed to begin hiking rates early, perhaps even before a strong recovery is certain. Nominal federal purchases are expected to increase by 7.1% in calendar 2002, up from a 3.9% increase in 2001.

Long Run U.S. Outlook and Assumptions Relevant to the Study

The longer-term trend effects of the macroeconomic and regional economies reflect steady-state levels and growth rates appropriate to the context of the supporting analysis. In particular, total U.S. population growth and employment serve as key drivers for overall growth as well as an important component in aggregation. The DRI•WEFA forecast for U.S. employment is determined within the context of the macroeconomic forecast, which integrates influences from external factors and across industry sectors. The long-term growth rate in employment depends directly on key labor market variables and influences from outside of the labor market, such as interest rate policy and corporate profits.

The DRI•WEFA macroeconomic model incorporates the many influences on the labor market and the growth in employment. There are however particular influences that more directly affect employment in the long run, the growth rate of real output, productivity growth, labor force growth, and projections in labor force participation rates. Over the forecast horizon for this study the U.S. employment growth ranges within 1.3% to 1.5%, which represents a full-employment growth rate, which leaves the unemployment rate between 4.2% and 4.4% during the forecast period. This long-run growth in employment is

consistent with real GDP growth of 3.2% to 3.5% and national productivity growth in the range of 2.2% to 2.5%.

Background and Overview to the Oregon/Portland Economy and Forecast Assumptions

More closely influencing the Portland/Vancouver commodity flow forecast are the economic forecasts for the region and the states of Oregon and Washington. A summary of the outlook for these geographic regions follows. Following its robust expansion during 1993-97, Oregon's economic growth decelerated sharply in 1998, as exports and foreign investment dropped off during the Asian crisis. Since then, Oregon has continued to struggle, as the national recession kept it from firmer ground. Indeed, in 2001, Oregon had the largest percent decline in employment in the United States. Total employment contracted in every quarter in 2001 and year-over-year growth languished in negative territory beginning in May 2001, dragged down by a precipitous drop in the manufacturing sector.

Manufacturing was particularly hampered by losses in transportation equipment and wood products industries. Heavy truck producer Freightliner, for example, reduced its Oregon workforce by 1,000 in 2001. The services, trade, and construction sectors fell victim to lower consumer spending. Fire, insurance, and real estate was one of the few sectors that avoided an employment contraction. Consequently, the unemployment rate leapt from 4.7% in the first quarter to 7.5% in December 2001.

The future holds only tepid growth for Oregon. The state's economic performance will hit bottom in 2002, as job growth declines further, from –0.8% in 2001 to -1.5% in 2002. In addition to the national slowdown, Oregon's economy is suffering from another dip in semiconductor chip prices, as investment in high-tech equipment declines and companies consolidate operations. Employment in the manufacturing sector will continue to retract throughout 2002, even as production levels off because employers will be slow to hire until they are sure of recovery, favoring adding overtime to existing workers before hiring new workers. The lumber, wood products, and paper industries will also continue to stagnate throughout the forecast period, but the transportation equipment sector is expected to begin to rebound in 2003, and show stronger growth in 2004.

Overall job growth will recover in 2003, as export-related markets regain some ground, and both high-tech and consumer spending rebound, boosting the construction and services sectors. Although employment growth will accelerate over the next five years, Oregon will not ramp up to strong gains until towards the end of the decade; the unemployment rate will remain at or above 7.8% through 2006. Trend growth in employment through the entire forecast period defined by the study is expected to range between 1.1% and 1.4%.

Traditional industries, such as timber, agriculture, fishing, and tourism, as well as a leading high-tech industry are key to the state's economy. Oregon has the fourth-largest concentration of semiconductor chip companies in the nation. High-tech companies are concentrated in the Portland metro area, the state's commercial center (making up roughly half of the population and employment), as well as in the Willamette Valley to the south, stretching down to Eugene-Springfield and Medford. Traditional resource-based industries remain an important component of the state's economy, dominating the southern and western parts of the state.

Business costs in Oregon are roughly on a par with the rest of the nation, and slightly lower in some areas. Oregon, like the rest of the region, benefits from relatively low energy costs. Moreover, the state has the lowest tax burden in the Pacific Northwest region, with state and local taxes amounting to 10% of personal income. Land is still fairly inexpensive and abundant, except in the Portland area, in which available land is becoming scarce, pushing up the cost of housing and industrial and commercial building. Wages have increased in the last decade, and are roughly commensurate with the national average. The price of skilled labor is high owing to its scarcity, however, especially in the Portland area.

The long-term view for the Oregon economy sees real Gross State Product in the range of 2.5% and 3.0% over the 2010-2030 study horizon. Consistent with this view is total employment growth in the range of 0.2% to 0.3%, although greater employment growth is expected in service industries, such as healthcare and business services.

Outlook for the Portland Metropolitan Area

The Commodity Flow Forecast Update focused on commodity flows in the six-county Portland metropolitan area that includes Clark County in Washington. This metropolitan area serves as the commercial and industrial center for most of the state of Oregon, as well as much of southern Washington. With 1.9 million residents, the metro area is home to more than half of the state's work force. Portland's influence stretches 110 miles south to the Eugene/Springfield area, including Salem and the entire Willamette Valley. Portland's rapid and diverse growth during most of the 1990s has resulted in a modern, diversified economy.

High-technology companies, many medium-to-light manufacturers, business services, and foreign trade are now key components of the metropolitan area economy, supplanting the former timber and agriculture-industry dominance of the past. Employment in the electronics industry alone is now comparable to that in the lumber and wood-products sector. With its geographic location on the Columbia River and its position at a cross roads in the national transportation network, the metro area is a key gateway for goods to and from Pacific Rim markets.

Portland's business costs have risen rapidly in the last decade, as land and housing costs increased with the influx of new residents and high-tech manufacturing plants. Relative to the rest of the nation, however, business costs are roughly on a par, and the region benefiting from relatively low energy costs and a business-friendly tax environment. Wages have risen about one percentage point faster than the national pace in the last decade, and are now roughly 5% above the U.S. average. The price of skilled labor is relatively high, especially in the Portland area.

Portland's economy did not live up to expectations during the late 1990s; total employment growth averaged only 2.4% annually in 1996–2000, while the regions neighbors from Seattle down through California were posting well into 3–4% gains during the e-commerce boom. Unfortunately, the Portland area has not proved to be immune to the economic slowdown affecting the rest of the country, either. Total employment contracted slightly in 2001, hurt by declines in manufacturing, construction, business services, trade, and transportation, communications, and utilities. The manufacturing sector sustained losses due to cuts by transportation equipment makers and semiconductor manufacturers, while services and trade were suffering the impacts of lower spending. The only good news came

from the health and "other" services sectors, which posted 3.5% and 3.1% growth, respectively.

The recovery in the economy is underway but some sectors are lagging, particularly the manufacturing sector, which contracted over 10% in 2001, which helped push the metropolitan area's unemployment rate up. Indeed, the increase in Portland's jobless rate was dramatic in 2001, increasing from 4.0% in January 2001 to almost 8.0% in December 2001.

Portland's outlook in 2002 is for only moderate improvement. The market for semiconductors has not recovered, and high-tech investments are still weak, particularly in the area serving the telecommunications industry. High unemployment and recession fears had driven down consumer spending, and nearly every sector is struggling to recover. As a result, total employment will decline by 1.8% in 2002. A slower rate of population increases (1.3% annually) will also restrain overall economic growth, which may prove to be partly beneficial if it helps to reduce the strains on infrastructure, housing, and the environment. A minor rebound in 2003 will proceed several years of lackluster growth; employment gains will average 0.6% in 2003–2010, as few sectors ever reach 1.0% growth.

Real output in the Portland metropolitan area is expected to range within 2.7% to 3.0% over the forecast horizon, 2010-2030. Long-term employment growth is projected to be somewhat flat for the Portland area with growth expected to average 0.5% over the study forecast horizon. This is consistent with the growth in population and net migration for the area.

SUMMARY OF CARGO FORECASTS

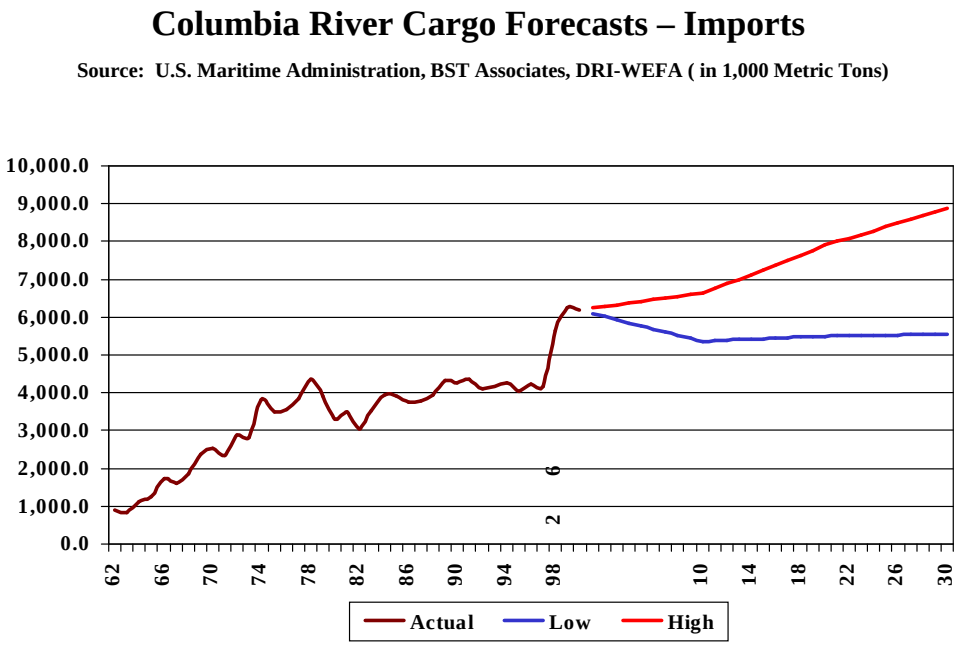
The following section summarizes the supply constrained forecasts as well as the forecasts with and without the Columbia River Deepening project.

Import Forecasts

The summary forecast of imports is provided in Figure 1. Imports increased very rapidly between 1962 and the late 1970s, and then were relatively flat from the early 1980s through the mid 1990s. As a result of the strength of the U.S. dollar and other related factors, imports surged between 1995 and 2000, growing at nearly 9% per year, surpassing 6 million tons in 2000.

The forecast calls for imports to reach a level between 5.5 million tons and 9 million tons by the year 2030, or at average annual rates of –0.02% and +1.2% under low and high growth scenarios, respectively.

Figure 1 – Supply Constrained Import Forecast



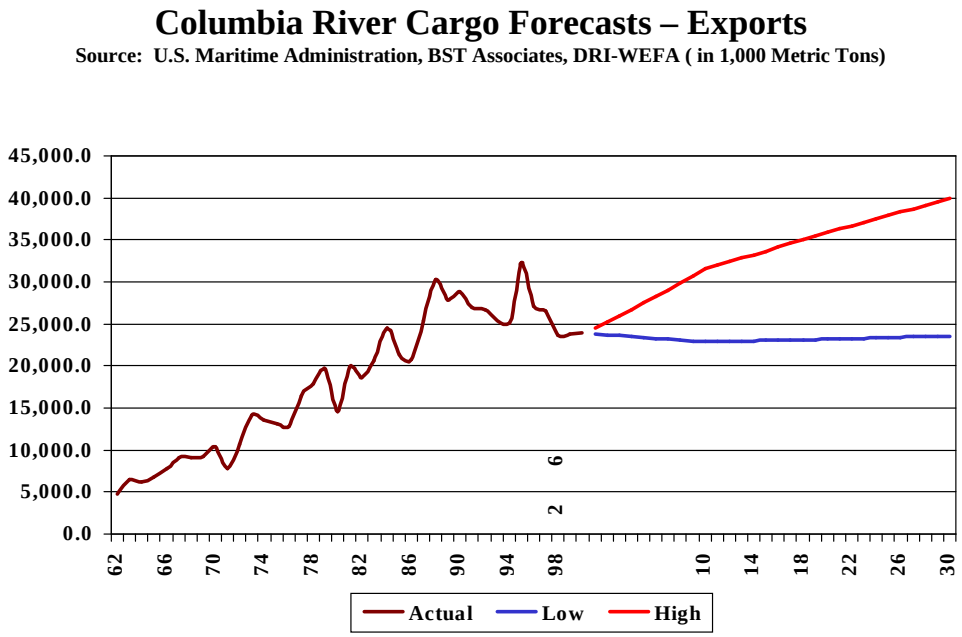
Export Forecasts

The summary forecast of exports is provided in Figure 2. Exports also increased rapidly between 1962 and 1990, and then peaked in 1995 when the value of the U.S. dollar was relatively low and exports (especially grain exports) were at their highest recorded levels. However, as a result of the Asian Financial crisis in 1997 and the strength of the U.S. dollar, exports declined from the peak in 1995 by nearly 9 million tons, falling from 32 million tons to 24 million tons.

The forecast calls for exports to reach a level between 23 million tons and 40 million tons by the year 2030, or at average annual rates of –0.05% and +1.7% under low and high growth scenarios, respectively.

Under the low forecast scenario, declines in log, breakbulk and dry bulk commodities are offset by gains in grain and container exports. Under the high growth scenario, commodities within each cargo handling groups are expected to increase.

Figure 2 – Supply Constrained Export Forecast



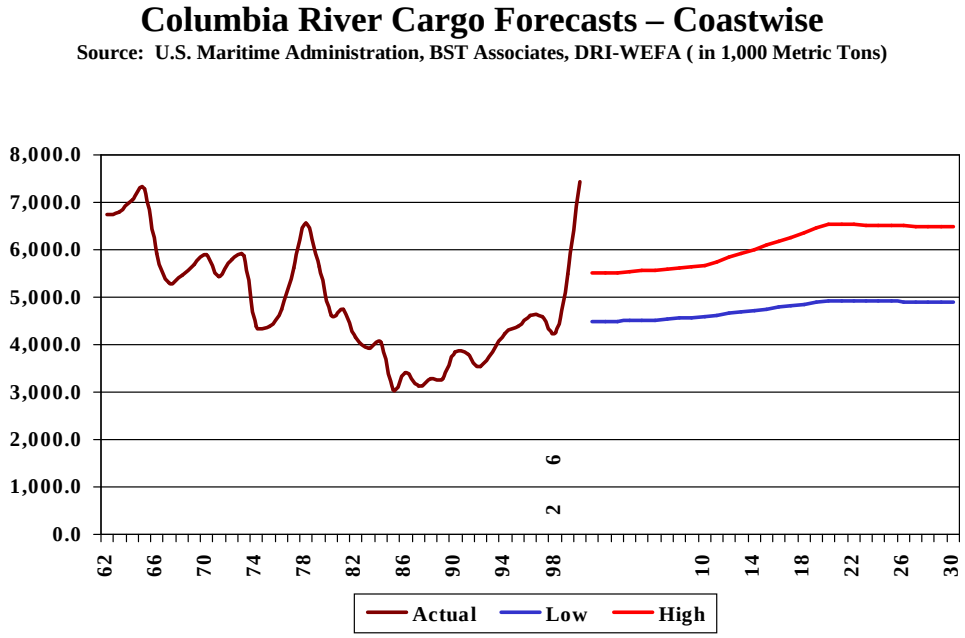
Coastwise Traffic Forecasts

Coastwise trade includes domestic waterborne receipts and shipments transiting the Columbia River. Domestic trade declined from 7 million tons in 1962 to 3 million tons in the mid 1980s.

As a result of the shutdown of the Olympic Pipeline in 1999/2000, waterborne receipts of petroleum products increased very rapidly (from 2 million tons in 1998 to nearly 6 million tons in 2000). However, the Olympic Pipeline was brought back on line in 2001 and petroleum products are again flowing from the Northern Puget Sound refineries to the Portland/Vancouver area by pipeline.

The forecast calls for coastal traffic to reach a level between 5 million tons and 6.5 million tons by the year 2030, or at average annual rates of 0.3% and 0.6% under low and high growth scenarios, respectively.

Figure 3 – Supply Constrained Coastwise Traffic Forecast

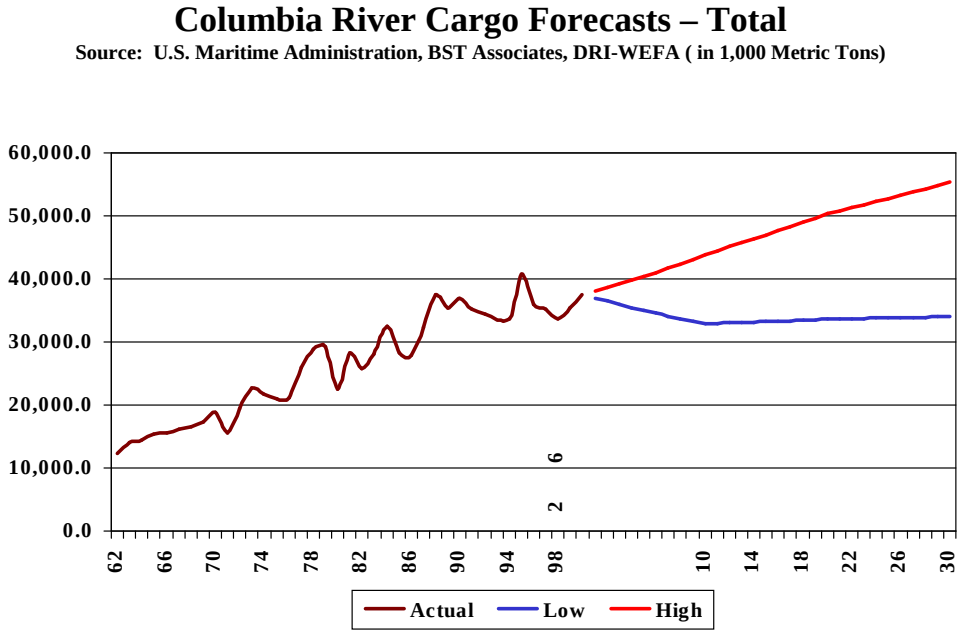


Total Traffic Forecasts

Total traffic transiting the Columbia River bar (exports, imports and coastwise traffic) is expected to range between 34 million tons and 55 million tons under low and high growth scenarios, respectively. This amounts to average annual growth of –0.3% per year under the low growth scenario and 1.3% per year under the high growth scenario. These forecasts are considered conservative by historical standards, since cargo growth averaged 3.0% per year between 1962 and 2000.

This forecast is constrained with respect to production capacity but not with respect to logistics. The impacts from the Columbia River deepening project are provided in the next section.

Figure 4 – Supply Constrained Foreign and Coastwise Traffic Forecast



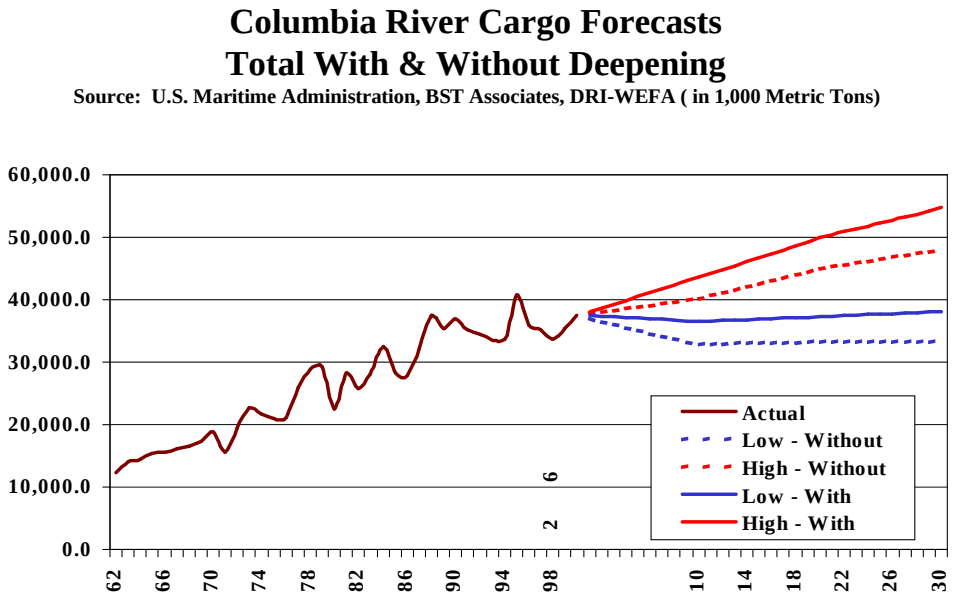
Forecasts with and without Deepening Project

The Columbia River deepening project is expected to increase containerized and grain traffic. There may also be a positive impact on breakbulk, dry bulk and liquid bulk cargoes as a result of the deepening project. However, these impacts were not included in the analysis.

Under without project conditions (existing 40-foot navigation channel), the forecast calls for waterborne traffic to reach a level between 33 million tons and 48 million tons by the year 2030, or at average annual rates of -0.4% and +0.8% under low and high growth scenarios between 2000 and 2030, respectively.

Under with project conditions (improved 43-foot navigation channel), the forecast calls for waterborne traffic to reach a level between 38 million tons and 55 million tons by the year 2030, or at average annual rates of 0.0% and 1.3% under low and high growth scenarios between 2000 and 2030, respectively.

Figure 5 – Forecasts With & Without Deepening Project



The details of the forecast by commodity and cargo handling group are provided in the following sections of the report.

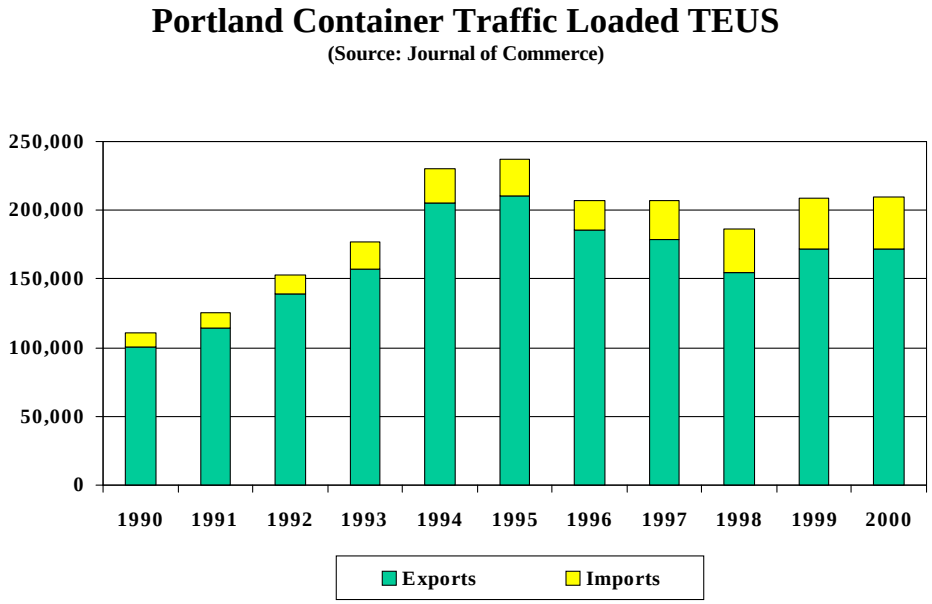
CONTAINERS

The DRI-WEFA commodity forecasts underlying this study are demand driven forecasts, meaning that they are unconstrained with respect to regional production capabilities and transportation logistics. For example, imports of consumer products are estimated based upon exchange rates, population, income and numerous other economic variables. These forecasts work well when there is no reason to believe that constraints will limit the potential volumes that can be shipped/received. However, export commodities may be constrained by production limitations such as changes in the inputs of production (acres in production and harvest, availability of water or other inputs). In addition, transportation logistics impact whether the Lower Columbia region ships/receives the commodity or whether it moves through another competitive gateway. The following chapter presents a summary of container forecasts, taking into account supply constraints and logistics constraints under with and without channel deepening conditions.

CHARACTERIZATION OF LOWER COLUMBIA RIVER CONTAINER MARKET

It is important to properly characterize the nature of the container market that Portland serves[1]. Portland primarily serves as an export load center for regionally produced agricultural, forest and other products.

Figure 6 – Portland Container Trends by Direction

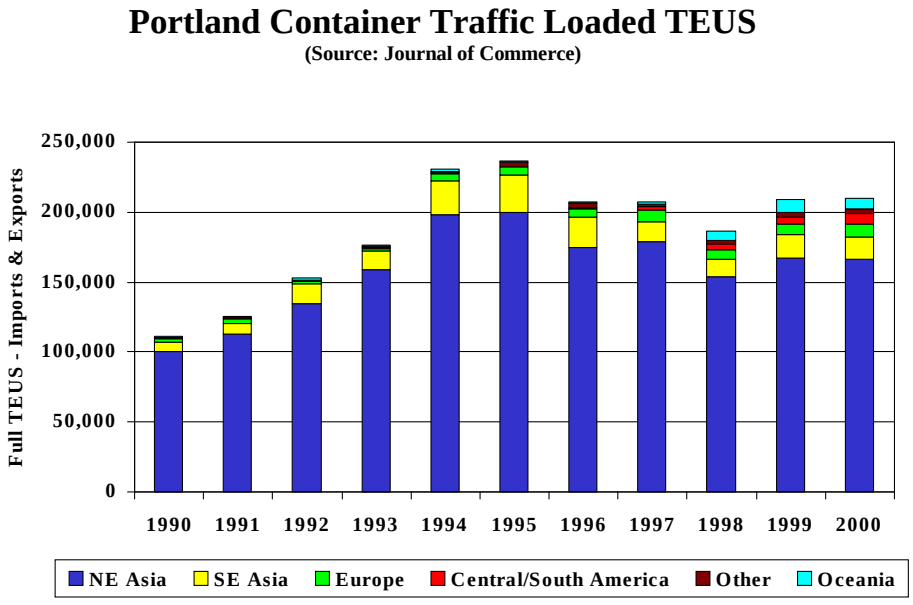


[1] Vancouver, Washington also handles some containers on general purpose breakbulk vessels. In 2000, the Port of Vancouver handled approximately 1,300 TEUs.

Exports accounted for 90% of container traffic in the beginning of the 1990s. However, as a result of the Asian financial crisis and the resulting high value of the U.S. dollar in overseas markets, export traffic has remained flat and accounted for 82% of container traffic in 2000. Imports comprised the remaining 18% of container traffic in 2000. It should be noted that exports from U.S. West Coast ports to NE and SE Asia fell at an average annual rate of (0.6%) between 1997 and 2000. During this period, Portland's exports fell 2%; however, Seattle declined at 9.8% and Long Beach at 3.9%.

Portland does not compete directly with container ports in California (i.e., Los Angeles, Long Beach, Oakland) or British Columbia (i.e., Vancouver Port Corporation) for commodity exports and imports. Rather, Portland competes primarily with the ports of Seattle and Tacoma for the hinterland serving the Port. This competitive relationship is more fully described below. However, Portland competes indirectly with other West Coast ports and to a lesser extent foreign ports, in that carriers usually limit their vessels to call at three or four ports on either side of ocean. Carriers will choose the mix of ports that best provides the cargo base for the destinations that are served.

Figure 7 – Portland Container Trends by Trade Route



As with other U.S. West Coast ports, the great majority of Portland container traffic is in service to Asia. NE Asia (i.e., Japan, Korea, Taiwan and the PRC) accounted for 90% of all container traffic in the early 1990s but declined to 80% in 2000. SE Asia (Singapore, Malaysia, Thailand, The Philippines, Indonesia) accounted for 6% of all container traffic through the Port in 1990, rising to 8% in 2000. Other trade routes (Europe, Oceania, Central/South America and all other trade routes) account for the remaining 13% in 2000, up from just 3% in 1990. The distinction between trade routes is important because vessels in

the Trans-Pacific trade (serving NE and SE Asia) tend to be much larger than vessels on other trade routes. This issue is discussed in greater detail in the section on channel deepening.

The local container market consists of an area including the state of Oregon, Southern Idaho, and the barge tributary serving Southeast Washington and Northern Idaho. Products in this market area can either move via Columbia River ports (primarily the Port of Portland) or container ports in Puget Sound (primarily Seattle and Tacoma).

Portland's share of the local market depends on a number of factors, including the number of containers moving to and from each country/region, the relative frequency of service provided by ocean carriers and relative inland transport costs, among other factors. The barge system on the Columbia/Snake River provides the lowest cost inland transportation service to shippers located near the river system. In addition, a significant amount of the local market is produced on the I-5 corridor south of Portland (Medford et al) and Portland is much closer by truck than alternative container ports.

SUPPLY-CONSTRAINED COMMODITY FORECAST

The following section describes the supply constrained export forecast for the hinterland served by the Lower Columbia River ports, as well as the commodity forecasts for imports. As mentioned above, some of the export cargoes shipped via the Port of Portland may have supply constraints, which preclude achieving the volumes forecast by DRI-WEFA based upon the demand conditions overseas. For example, hay is consumed in both domestic and export markets. It is important to evaluate whether the forecast projects a realistic percentage of the commodity production, which is bound for overseas markets. In those cases where the demand driven forecasts appear too high, they have been ratcheted downward to reflect the potential supply constraint.

Description of Containerized Commodities

It is first important to discuss which products are moving in containers at the present time. As shown in Table 1, the main export containerized commodities are:

- Forest products (paper/paperboard, lumber, waste paper, milk carton stock, fiberboard, newsprint and wood pulp),
- Agricultural products (hay, potatoes, whey, lentils, corn, onions and other products, flour meal and malt), and
- Other products (base metals, hides and skins, etc.).

As Table 1 also shows, the main import containerized commodities are:

- Building materials and industrial inputs (lumber, paper/paperboard, iron/steel products, logs, flour meal, fasteners and other wood products), and,
- Consumer products (lumber/wood products, wine, furniture and tiles, footwear, auto parts, toys, appliances, apparel, pineapple).

Table 1 – Key Containerized Cargoes (1,000 Metric Tons)

Rank	Product Description	Exports	% Total	Rank	Product Description	Imports	% Total
1	Hay And Animal Feed	615.4	32%	1	Lumber, Softwood	64.1	20%
2	Paper & Paperboard	162.2	8%	2	Wine	13.8	4%
3	Lumber, Softwood	139.5	7%	3	Paper & Paperboard	13.0	4%
4	Waste Paper	118.8	6%	4	Furniture	9.9	3%
5	Milk Carton Stock	112.6	6%	5	Footwear	9.0	3%
6	Potatoes, Frozen	91.3	5%	6	Lumber, Hardwood	8.9	3%
7	Lumber, Hardwood	44.7	2%	7	Unglazed Ceramic Flags	7.7	2%
8	Wood Pulp	39.6	2%	8	Auto Parts Excluding Wheels	6.5	2%
9	Lentils, Dried Shelled	38.8	2%	9	Apparel	5.7	2%
10	Other Base Metals	35.2	2%	10	Coniferous Logs	5.6	2%
11	Whey	34.1	2%	11	Chain Of Iron Or Steel	5.1	2%
12	Flour Meal & Pellet Meat	24.3	1%	12	Tires	4.9	2%
13	Sweet Corn, Not Frozen	22.2	1%	13	Pineapples	4.0	1%
14	Articles Of Asphalt	20.3	1%	14	Toys	4.0	1%
15	Peas, Dried Shelled	19.6	1%	15	Flour Meal/Pellet Of Fish	3.5	1%
16	Fiberboard/Particle Board	19.3	1%	16	Electric Lamps/Fittings	2.9	1%
17	Onions/Shallots, Fresh/Chilled	18.6	1%	17	Screws, Bolts, Nuts, Washers	2.8	1%
18	Hides & Skins	16.2	1%	18	Wood, Tongued, Grooved etc.	2.7	1%
19	Newsprint	16.2	1%	19	Electrical Parts Of Machinery	2.7	1%
20	Malt, Not Roasted	15.8	1%	20	Fiberboard And Particle Board	2.6	1%
	Other	328.7	17%		Other	144.0	45%
	Total Exports	1,933.4	100%		Total Imports	323.3	100%

Source: Port of Portland using data from U.S. MARAD and PIERS

Forecasts by Commodity - Exports

The following section describes current production capability and the percent of production that is exported overseas. If production capacity were to increase, the percentages of exports to production would be expected to decrease. As a result, these supply-constrained forecasts are considered conservative.

In addition, several of these products are considered swing products in that they can move in either containerized or breakbulk form. This section also addresses the percent of cargo moving in containerized and breakbulk form for major commodities.

Hay and Animal Feed

The hay and animal feed exported via Lower Columbia River ports consists of alfalfa cubes, timothy hay and ryegrass straw, among other products, which are produced in Eastern Washington and Oregon, Western Oregon (in the Willamette and Klamath river valleys) and to a lesser extent in Idaho. Within the states of Washington, Idaho and Oregon, approximately 10 to 12 million tons of these products were produced annually during the

past ten years. Between 1990 and 1999, production increased at an average rate of 1.5% per year.

Most of the product is used in domestic markets. However, approximately 12% of the crop is currently exported in containers bound for Asia from the Lower Columbia River ports. None of this product moves in breakbulk or bulk form.

The supply constrained forecast for hay and animal feed calls for annualized growth of 1.4% (low) to 2.3% (high) per year during the study forecast period. The projected forecast in 2030 would amount to 18% to 36% of existing (year 2000) production levels.

Paper and Paperboard

Paper products that are exported via Lower Columbia River ports include milk carton stock, linerboard, paperboard and related products. Taking all of these products together, there were approximately 165,000 tons exported in 2000, of which approximately 95% to 100% was shipped in containers.

Export volumes account for approximately 18% of current production capacity. The supply constrained forecast calls for exports to grow at average rates of 1.0% (low) to 2.5% (high) per year from 2000 to 2030. Under these forecasts, exports via the Columbia River ports are expected to range from 24% (low) to 43% (high) of existing (year 2000) production capacity.

Newsprint

Newsprint moves in both breakbulk and containerized form. In recent years, approximately 85% to 95% of newsprint has moved in breakbulk form with remainder moving in containers. Virtually all of the breakbulk newsprint is generated at the Norpac Paper plant in Longview.

The containerized portion of newsprint is expected to grow at average rates of growth of between 1.5% (low) and 3.2% (high) per year. Approximately 2% of production in the tri-state area is exported by container. If production levels remain constant, the forecast projects that containerized exports would reach 3% (low) to 5% (high) of existing production levels.

Lumber

During the past four years, lumber exports via Lower Columbia River ports have ranged from 200,000 to 275,000 metric tons per year. An increasing share of these products is containerized, increasing from 56% in 1997 to 89% in 2000.

According to the Western Woods Products Association, lumber exports currently account for 3.3% of PNW lumber production (i.e., 0.3% of Idaho, 2.7% of Oregon and 5.6% of Washington production, respectively). In 1989, approximately 9.2% of the lumber produced in these three states was exported.

The supply constrained forecasts estimate that lumber exports will increase at between 1.0% (low) and 3.1% (high), representing between 4% (low) and 8% (high) of existing productive capacity.

Potatoes, Frozen

Frozen potato product exports (mainly French fries) have ranged from 80,000 to 110,000 tons in the past four years, moving exclusively in containerized form.

Potato production in Washington, Oregon and Idaho increased from 10.8 million tons in 1993 to 13.1 million tons in 2000, or at an average annual rate of 2.8% per year. Exports account for approximately 14% of domestic potato production at the present time.

The supply constrained forecast projects potato exports will grow at between 1.8% (low) and 3.0% (high) per year between 2000 and 2030. This level of export represents approximately 24% (low) to 58% (high) of existing production levels.

Peas and Lentils

Dried pea and lentil exports reached 58,400 tons in 2000 and moved exclusively in containers. Total production decreased from 240,000 tons in 1993 to 183,000 tons in 2000 or at –3.9% per year. However, production was volatile during this period, ranging from a high of 290,000 tons in 1995 to a low of 141,000 tons in 1996.

Exports moving via the Lower Columbia River ports amounted to approximately 28% of production in 2000. Under the supply-constrained forecast, peas/lentils are projected to grow at between 0.6% (low) and 2.4% (high) per year between 2000 and 2030. Export volumes moving via the Lower Columbia River ports would account for between 34% (low) and 57% (high) of existing (year 2000) production levels.

Woodpulp

Woodpulp is an interim product used in the papermaking process. Woodpulp is created by breaking wood down into individual fibers, using one of two different methods – mechanical or chemical. PNW mills currently have the capacity to produce about 517,000 tons of pulp per year. Columbia River woodpulp exports ranged from 100,000 to 173,000 tons during the past four years. Containerized volumes have increased from 8% in 1997 to 36% in 1999, but the majority of this product still moves in breakbulk form. Exports currently represent 41% of the productive capacity in the Lower Columbia River hinterland. The supply constrained forecast projects wood pulp exports growing at between 1.0% (low) and 1.7% (high) from 2000 to 2030. Under this forecast, pulp exports (i.e., containerized and breakbulk forms) in 2030 would represent between 41% (low) and 55% (high) of existing production levels.

Summary

As shown in Table 2, the supply constrained forecast projects that containerized exports via Lower Columbia River ports will grow from 1.9 million tons in 2000 to a range between:

- Low forecast of 3.1 million tons by 2030, at an average growth rate of 1.6% per year,
- High forecast of 4.8 million tons by 2030, at an average growth rate of 3.1% per year.

Table 2 – Supply Constrained Forecasts of Key Export Commodities (1,000 metric tons)

			2030		Growth Rates 2000-2030	
Rank	**Product Description**	**2000**	**Low**	**High**	**Low**	**High**
1	Hay And Animal Feed	615.4	933.9	1,217.3	1.4%	2.3%
2	Paper & Paperboard	162.2	218.6	340.2	1.0%	2.5%
3	Lumber, Softwood	139.5	188.1	384.3	1.0%	3.4%
4	Waste Paper	118.8	215.2	323.1	2.0%	3.4%
5	Milk Carton Stock	112.6	151.7	318.9	1.0%	3.5%
6	Potatoes, Frozen	91.3	155.9	221.5	1.8%	3.0%
7	Lumber, Hardwood	44.7	60.2	80.9	1.0%	2.0%
8	Wood Pulp	39.6	53.4	66.0	1.0%	1.7%
9	Lentils, Dried Shelled	38.8	43.0	81.4	0.3%	2.5%
10	Other Base Metals	35.2	30.3	40.9	-0.5%	0.5%
11	Whey	34.1	41.6	126.0	0.7%	4.5%
12	Flour Meal & Pellet Meat	24.3	90.1	151.6	4.5%	6.3%
13	Sweet Corn, Not Frozen	22.2	21.8	40.1	-0.1%	2.0%
14	Articles Of Asphalt	20.3	25.0	31.8	0.7%	1.5%
15	Peas, Dried Shelled	19.6	26.4	36.1	1.0%	2.1%
16	Fiberboard/Particle Board	19.3	20.2	38.3	0.2%	2.3%
17	Onions/Shallots, Fresh/Chilled	18.6	27.4	42.2	1.3%	2.8%
18	Hides & Skins	16.2	49.6	92.6	3.8%	6.0%
19	Newsprint	16.2	25.0	41.7	1.5%	3.2%
20	Malt, Not Roasted	15.8	28.5	52.0	2.0%	4.0%
	Misc	328.7	725.8	1,101.6	2.7%	4.8%
	Grand Total	1,933.4	3,131.8	4,828.7	1.6%	3.1%

Source: BST Associates, DRI-WEFA

Export Forecast by Trade Route

The demand driven and supply constrained growth rates for containerized exports to major trading regions are presented in Table 3. As can be seen, in all cases, the supply constrained growth rates are lower than the demand driven forecast growth rates.

In total (all trade routes), the demand driven forecasts project growth between 2.7% (low) and 4.8% (high). The supply constrained forecasts are expected to rage from 1.6% (low) to 3.1% (high). For NE Asia, the largest trading partner for Pacific Northwest ports, the demand driven growth rates are expected to range between 2.5% (low) and 4.5% (high) as compared with the supply-constrained rates of 1.5% (low) to 2.9% (high).

Table 3 – Comparison of Demand Driven and Supply Constrained Export Growth Rates

Exports - Demand Driven Forecasts								
	Annualized Growth Rates - Low				**Annualized Growth Rates - High**			
Trade Route	**2000-2010**	**2010-2020**	**2020-2030**	**2000-2030**	**2000-2010**	**2010-2020**	**2020-2030**	**2000-2030**
Europe	2.5%	2.4%	1.9%	2.3%	4.0%	4.1%	3.6%	4.0%
Former USSR	1.8%	1.5%	1.1%	1.5%	3.0%	2.8%	2.4%	2.8%
North America	3.9%	4.3%	3.7%	4.0%	5.9%	6.5%	6.0%	6.2%
Northeast Asia	2.3%	2.7%	2.3%	2.5%	4.3%	4.8%	4.5%	4.5%
Oceania	1.9%	2.1%	1.6%	1.9%	3.6%	4.0%	3.7%	3.8%
South Asia	3.8%	3.5%	2.9%	3.5%	5.9%	6.0%	5.5%	5.9%
Southeast Asia	3.0%	3.8%	3.5%	3.4%	5.4%	6.4%	6.3%	6.0%
Other	2.9%	3.2%	2.9%	3.0%	5.4%	5.9%	5.6%	5.6%
Total	2.5%	2.9%	2.5%	2.7%	4.5%	5.1%	4.8%	4.8%
Exports - Supply Constrained Forecasts								
	Annualized Growth Rates - Low				**Annualized Growth Rates - High**			
Trade Route	**2000-2010**	**2010-2020**	**2020-2030**	**2000-2030**	**2000-2010**	**2010-2020**	**2020-2030**	**2000-2030**
Europe	1.5%	1.5%	1.1%	1.4%	2.6%	2.7%	2.3%	2.6%
Former USSR	1.1%	0.9%	0.7%	0.9%	1.9%	1.8%	1.6%	1.8%
North America	2.4%	2.6%	2.2%	2.5%	3.8%	4.2%	3.8%	4.0%
Northeast Asia	1.4%	1.7%	1.4%	1.5%	2.7%	3.1%	2.9%	2.9%
Oceania	1.2%	1.3%	1.0%	1.2%	2.3%	2.6%	2.4%	2.4%
South Asia	2.3%	2.2%	1.8%	2.2%	3.8%	3.9%	3.5%	3.8%
Southeast Asia	1.9%	2.3%	2.2%	2.1%	3.5%	4.1%	4.1%	3.9%
Other	1.8%	2.0%	1.8%	1.9%	3.5%	3.8%	3.6%	3.6%
Total	1.5%	1.8%	1.6%	1.6%	2.9%	3.3%	3.1%	3.1%

Source: BST Associates, DRI-WEFA

Forecasts by Commodity - Imports

As previously indicated, imports are either inputs to manufacturing and/or construction processes or consumer goods. Imports are driven by the demand from domestic consumption (local and more distant intermodal markets) and are not supply constrained.

Table 4 presents low and high import container forecasts for import commodities. Under the low growth scenario, import tonnage is expected to grow at an average annual rate of 3.7%, reaching 954,000 tons in 2030. Under the high growth scenario, import tonnage is expected to grow at an average annual rate of 5.7%, reaching 1.7 million tons.

Table 4 – Containerized Imports (1,000 Metric Tons)

			2030		Growth Rates 2000-2030	
Rank	**Product Description**	**2000**	**Low**	**High**	**Low**	**High**
1	Lumber, Softwood	64.1	180.7	412.7	3.5%	6.4%
2	Wine	13.8	17.9	35.9	0.9%	3.2%
3	Paper & Paperboard	13.0	25.2	34.7	2.2%	3.3%
4	Furniture	9.9	50.7	84.0	5.6%	7.4%
5	Footwear	9.0	53.3	71.2	6.1%	7.1%
6	Lumber, Hardwood	8.9	25.0	57.1	3.5%	6.4%
7	Unglazed Ceramic Flags	7.7	12.4	15.7	1.6%	2.4%
8	Auto Parts Excluding Wheels	6.5	14.7	19.0	2.7%	3.6%
9	Apparel	5.7	28.1	37.3	5.5%	6.5%
10	Coniferous Logs	5.6	9.2	12.1	1.6%	2.6%
11	Chain Of Iron Or Steel	5.1	5.6	9.8	0.3%	2.2%
12	Tires	4.9	10.9	14.1	2.7%	3.6%
13	Pineapples	4.0	17.3	27.1	5.0%	6.6%
14	Toys	4.0	10.6	23.8	3.3%	6.1%
15	Flour Meal/Pellet Of Fish	3.5	4.6	5.1	0.9%	1.2%
16	Electric Lamps/Fittings	2.9	17.1	27.7	6.1%	7.8%
17	Screws, Bolts, Nuts, Washers	2.8	7.7	11.3	3.5%	4.8%
18	Wood, Tongued, Grooved etc.	2.7	7.6	17.3	3.5%	6.4%
19	Electrical Parts Of Machinery	2.7	11.3	18.3	5.0%	6.6%
20	Fiberboard And Particle Board	2.6	7.3	16.6	3.5%	6.4%
	Misc	144.0	436.6	747.2	3.8%	5.6%
	Grand Total	323.3	953.9	1,697.9	3.7%	5.7%

Source: BST Associates, DRI-WEFA

Summary of Supply-Constrained Container Forecasts

This section presents the methodology used to forecast Columbia River containerized trade. This process includes estimating the size of the local Trans-Pacific traffic base and Portland's share of this base, intermodal cargo on Trans-Pacific trade routes, and containerized trade with non-Trans-Pacific trade partners. These elements compose the number of full containers and, when summed with the number of empty containers, make up the total container forecast.

Forecast of Trans-Pacific Hinterland Container Traffic

As indicated previously, containers exported via Portland primarily come from the hinterland composed of Oregon, Southwest Washington and Northern Idaho. The export market increased steadily from 171,700 TEUS in 1991 to 248,200 TEUS in 2000, growing at 4.2% per year. The export cargo base is expected to continue to grow at annual rates of 1.5% to 1.7% under the low forecast scenario and 2.8% to 3.3% under the high forecast scenario, through the end of the study period.

The import market increased from 27,300 TEUS in 1991 to 57,900 TEUS in 2000, growing at 8.7% per year. The Trans-Pacific import cargo base is expected to grow at annual rates of 3.6% to 4.0% (low) and 5.7% to 6.1% (high) through the end of the study period.

Table 5 – Estimate of the Local Transpacific Container Market (1,000s of full TEUS)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	171.7			27.3			199.0		
1992	177.1			28.3			205.4		
1993	180.3			34.0			214.3		
1994	201.7			36.5			238.2		
1995	226.0			39.6			265.6		
1996	238.0			40.2			278.2		
1997	244.9			45.4			290.3		
1998	218.7			48.3			267.0		
1999	236.2			53.6			289.8		
2000	248.2			57.9			306.1		
Forecast									
2010		287.4	328.2		83.7	100.5		371.2	428.7
2020		341.7	452.1		123.8	181.8		465.5	633.9
2030		397.3	610.3		176.1	316.4		573.4	926.8
Compound Annual Growth Rates									
1991-2000	4.2%			8.7%			4.9%		
2000-2010		1.5%	2.8%		3.8%	5.7%		1.9%	3.4%
2010-2020		1.7%	3.3%		4.0%	6.1%		2.3%	4.0%
2020-2030		1.5%	3.0%		3.6%	5.7%		2.1%	3.9%
2000-2030		1.6%	3.0%		3.8%	5.8%		2.1%	3.8%

Source: Port of Portland, BST Associates, DRI-WEFA

Portland Market Share of Hinterland Traffic

As described in Table 6, during the period from 1991 to 2000, Portland's share of the hinterland market changed as follows:

- Exports:
  - Between 54% and 78% of the export containers generated in the hinterland moved via Portland and the remainder moved via Puget Sound ports.
  - The forecast calls for Portland to capture 55% to 61% (low) and 60% to 68% (high) of export traffic generated in the hinterland.
- Imports:
  - Between 38% and 62% of the import containers moved via Portland and the remainder moved via Puget Sound ports.
  - The forecast calls for Portland to capture 35% to 45% (low) and 40% to 50% (high) of import traffic generated in the hinterland.

Table 6 – Portland Capture of Hinterland Trans-Pacific Container Traffic (%)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	55%			38%			53%		
1992	67%			48%			64%		
1993	76%			57%			73%		
1994	78%			62%			76%		
1995	67%			55%			65%		
1996	64%			48%			62%		
1997	57%			45%			55%		
1998	54%			45%			52%		
1999	62%			43%			58%		
2000	61%			40%			57%		
Forecast									
2010		61%	68%		45%	50%		57%	64%
2020		60%	65%		40%	45%		55%	59%
2030		55%	60%		35%	40%		49%	53%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

Under both low and high growth scenarios, Portland is expected to gradually lose market share to Puget Sound container ports. However, it is important to note that container volumes continue to grow in Portland.

The resulting local Trans-Pacific container traffic forecast is developed by multiplying Portland's market share times the total expected volumes. As shown in Table 7, Portland is expected to increase local exports from 151,400 TEUS in 2000 to between 217,200 TEUS (low) and 366,200 TEUS (high) in 2030.

Local import TEUS from Trans-Pacific trading partners are expected to increase from 23,200 TEUS in 2000 to between 61,600 TEUS (low) and 126,600 TEUS (high) in 2030.

The combined imports and exports are projected to increase from 174,600 TEUS in 2000 to between 278,800 TEUS (low) and 492,800 TEUS (high) in 2030. This amount to average annual growth of between 1.6% and 3.5% between 2000 and 2030.

Table 7 – Portland Local Trans-Pacific Container Forecasts (1,000s of full TEUS)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	94.4			10.4			104.8		
1992	118.7			13.6			132.2		
1993	137.0			19.4			156.4		
1994	157.3			22.6			180.0		
1995	151.4			21.8			173.2		
1996	152.3			19.3			171.6		
1997	139.6			20.4			160.0		
1998	118.1			21.7			139.8		
1999	146.4			23.0			169.5		
2000	151.4			23.2			174.6		
Forecast									
2010		175.0	223.2		37.7	50.2		212.7	273.4
2020		204.2	293.9		49.5	81.8		253.7	375.7
2030		217.2	366.2		61.6	126.6		278.8	492.8
Compound Annual Growth Rates									
1991-2000	5.4%			9.3%			5.8%		
2000-2010		1.5%	4.0%		5.0%	8.1%		2.0%	4.6%
2010-2020		1.6%	2.8%		2.8%	5.0%		1.8%	3.2%
2020-2030		0.6%	2.2%		2.2%	4.5%		0.9%	2.8%
2000-2030		1.2%	3.0%		3.3%	5.8%		1.6%	3.5%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

Forecast of Intermodal Trans-Pacific Container Traffic

In addition to the local Trans-Pacific market, there are also intermodal containers that originate in or are destined for other areas of the US. As shown in Table 8, intermodal export traffic decreased from 16,800 TEUS in 1991 to 12,500 TEUS in 2000. The forecast calls for intermodal export traffic to increase to between 26,800 TEUS (low) and 91,600 TEUS (high) by the year 2030.

Import intermodal traffic via Portland decreased from 500 TEUS in 1991 to 100 TEUS in 2000. The forecast calls for intermodal import traffic to increase to between 2,400 TEUS (low) and 6,700 TEUS (high) by the year 2030.

Table 8 – Portland Trans-Pacific Intermodal Container Forecast (1,000s of full TEUS)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	16.8			0.5			17.3		
1992	19.5			0.5			20.0		
1993	21.0			0.5			21.5		
1994	45.0			0.1			45.1		
1995	55.0			1.7			56.7		
1996	40.0			0.1			40.1		
1997	33.0			3.0			36.0		
1998	29.6			0.1			29.7		
1999	16.4			0.1			16.5		
2000	12.5			0.1			12.6		
Forecast									
2010		15.9	39.4		1.0	1.3		16.8	40.7
2020		21.0	73.5		1.6	3.0		22.5	76.4
2030		26.8	91.6		2.4	6.7		29.2	98.2
Compound Annual Growth Rates									
1991-2000	-3.2%			-16.4%			-3.5%		
2000-2010		2.4%	12.2%		25.3%	29.1%		2.9%	12.4%
2010-2020		2.8%	6.4%		5.0%	8.7%		3.0%	6.5%
2020-2030		2.5%	2.2%		4.5%	8.4%		2.6%	2.5%
2000-2030		2.6%	6.9%		11.2%	15.0%		2.8%	7.1%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

Forecast of Container Traffic on Other Trade Routes

During the period from 1991 to 2000, exports to other trade routes (i.e., non Trans-Pacific trade routes include Europe, Oceania, South America and other routes) increased from 3,400 TEUS in 1991 to 11,300 TEUS in 2000, or at an average annual growth rate of 14.3%. Likewise, imports from other trade routes also grew rapidly during this period, from 1,400 TEUS in 1991 to 16,000 TEUS in 2000, or at an average annual growth rate of 31%.

As shown in Table 9, exports are expected to grow to between 23,900 TEUS (low) and 37,300 TEUS (high) by 2030. This amounts to average annual growth rates of 2.5% (low) to 4.1% (high) between 2000 and 2030.

Imports are expected to grow to between 34,900 TEUS (low) and 44,600 TEUS (high) by 2030. This amounts to average annual growth rates of 2.6% (low) to 3.5% (high) between 2000 and 2030.

Table 9 – Portland Non-Trans-Pacific Container Forecast (1,000s of full TEUS)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	3.4			1.4			4.8		
1992	3.5			1.1			4.6		
1993	3.2			1.5			4.7		
1994	5.8			2.4			8.2		
1995	7.0			3.5			10.5		
1996	7.0			3.9			10.9		
1997	7.5			6.2			13.8		
1998	10.0			9.9			19.9		
1999	10.8			14.2			25.1		
2000	11.3			16.0			27.3		
Forecast									
2010		16.6	19.0		21.2	22.6		37.7	41.6
2020		20.2	26.9		27.7	32.1		47.9	59.0
2030		23.9	37.3		34.9	44.6		58.8	81.9
Compound Annual Growth Rates									
1991-2000	14.3%			31.0%			21.3%		
2000-2010		3.9%	5.3%		2.8%	3.5%		3.3%	4.3%
2010-2020		2.0%	3.6%		2.7%	3.6%		2.4%	3.6%
2020-2030		1.7%	3.3%		2.3%	3.3%		2.1%	3.3%
2000-2030		2.5%	4.1%		2.6%	3.5%		2.6%	3.7%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

Summary of Supply-Constrained Forecasts

Table 10 presents a summary of the supply constrained container forecasts, including all trade routes and full and empty containers. Empty containers have consistently accounted for approximately 25% of all container traffic passing through the Port of Portland and are expected to remain at this level throughout the study period.

Export containers are expected to grow from 219,200 TEUS in 2000 to between 352,500 (low) and 651,400 TEUS (high) by the year 2030, or at average annual rates of between 1.6% (low) and 3.7% (high).

Import containers are expected to grow from 69,000 TEUS in 2000 to between 133,700 (low) and 240,200 TEUS (high) by the year 2030, or at average annual rates of between 2.2% (low) and 4.2% (high).

Total containers are expected to grow from 288,100 TEUS in 2000 to between 486,200 (low) and 891,700 TEUS (high) by the year 2030, or at average annual rates of between 1.8% (low) and 3.8% (high).

Table 10 – Total Container Forecast on All Trade Routes (1,000s of full & empty TEUS)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	117.3			55.8			173.2		
1992	149.3			61.6			210.9		
1993	171.6			66.3			237.9		
1994	217.1			94.2			311.4		
1995	221.2			99.9			321.1		
1996	202.7			100.5			303.2		
1997	183.6			105.4			289.0		
1998	176.7			81.0			257.8		
1999	198.7			84.2			282.9		
2000	219.2			69.0			288.1		
Forecast									
2010		272.9	370.4		80.8	100.2		353.7	470.6
2020		322.8	518.7		106.4	158.0		429.3	676.7
2030		352.5	651.4		133.7	240.2		486.2	891.7
Compound Annual Growth Rates									
1991-2000	7.2%			2.4%			5.8%		
2000-2010		2.2%	5.4%		1.6%	3.8%		2.1%	5.0%
2010-2020		1.7%	3.4%		2.8%	4.7%		2.0%	3.7%
2020-2030		0.9%	2.3%		2.3%	4.3%		1.3%	2.8%
2000-2030		1.6%	3.7%		2.2%	4.2%		1.8%	3.8%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

CONTAINER FORECASTS WITH & WITHOUT CHANNEL DEEPENING

The following section presents low and high forecasts for containers under with and without channel deepening conditions.

Impact of Larger Container Ships

One of the primary factors impacting the Columbia River's market share is its ability to accommodate larger vessels. This issue is explored in the following section.

Existing Fleet Composition

The characteristics of the existing large vessel (Panamax and Post-Panamax) container fleet are presented in Table 11. As can be seen, the container fleet is relatively new, with nearly 60% of the vessels less than 10 years of age.

In terms of capacity, nearly 70% of the fleet capacity is on vessels that are less than 10 years old. The typical life of a container ship is approximately 20 years, which indicates that most of the fleet will be in service through the next 15 years.

Table 11 – Panamax and Post-Panamax Container Fleet

	Number of Ships						Capacity in 1,000 TEU					
	Age Profile (years)						Age Profile (years)					
Vessel Size (TEUS)	**25+**	**20-24**	**15-19**	**10-14**	**5-9**	**0-4**	**25+**	**20-24**	**15-19**	**10-14**	**5-9**	**0-4**
3000/3499 TEUS	1	6	42	24	42	29	3.2	18.9	132.5	75.7	137	97.9
3500/3999 TEUS		2	4	30	41	26		7.7	15.3	113	151.2	99.3
4000&+(Panamax)			9	10	47	71			41.5	43.4	200.1	308.2
Total Panamax	1	8	55	64	130	126	3.2	26.6	189.3	232	488.3	505.3
4000/4499 TEUS				7	9	6				30.6	39.6	22.2
4500/4999 TEUS					20	2					96.7	9.8
5000/5499 TEUS					9	27					47.9	142.3
5500/5999 TEUS					7	58					38.9	326.1
6000+ TEUS					4	55					25.7	364.8
Total Post-Panamax				7	49	148				30.6	248.7	865.2
TOTAL	232.0	323.0	427.0	356.0	844.0	1,101.0	182.4	384.5	801.5	789.7	1,860.8	2,858.5

Source: Clarkson Research as of February 2002

Container Fleet Orderbook

The fleet order book is indicative of near-term future decisions by container fleet operators. The decision to add capacity is being driven by relatively low construction prices, low interest rates and the potential lower operating costs afforded by larger vessels, assuming they achieve proper load factors. However, the supply of containership capacity has exceeded demand in recent years, which has lead to falling rates and poor financial performance. As a result, some of the vessels on order may be delayed.

During the period 1996 through 2002, there were 351 container vessels delivered with a carrying capacity exceeding 3,000 TEUS on the order book. The average size of the vessel increased from approximately 4,500 TEUS to approximately 5,000 TEUS during this time period. As can be seen in Table 12, approximately 80% of the vessels ordered had a capacity of less than 6,000 TEUS:

- 23% of the vessels had a capacity of 3,000 to 3,999 TEUS,
- 27% of the vessels had a capacity of 4,000 to 4,999 TEUS,
- 32% of the vessels had a capacity of 5,000 to 5,999 TEUS,
- 14% of the vessels had a capacity of 6,000 to 6,999 TEUS,
- 5% of the vessels had a capacity of 7,000 or more TEUS,

The existing order book for container vessels suggests that there will be construction of 180 new large container vessels during the next three years. This could represent an increase of 7% in the number of ships. More importantly, it would represent an increase of approximately 16% in capacity. In addition, a substantial share of the capacity (nearly 30% of vessels representing 39% of capacity) is accounted for by vessels capable of handling 6,000 or more TEUS (nominal capacity).

Table 12 – Current Order book for New Large Container Ships

Size	Deliveries								Order-	
(TEUs)	1996	1997	1998	1999	2000	2001	2002	Total	book	Total
3000/3499	10	12	7	0	5	6	2	42	25	67
3500/3999	4	7	15	0	0	10	2	38	8	46
4000/4499	10	9	12	9	9	8	6	63	56	119
4500/4999	5	9	5	0	10	0	2	31	17	48
5000/5499	6	14	4	0	6	6	4	40	2	42
5500/5999	7	0	3	10	19	28	4	71	22	93
6000/6499	4	3	4	0	5	15	8	39	23	62
6500/6999	0	0	0	0	0	7	2	9	10	19
7000/7499	0	2	4	4	4	2	2	18	5	23
7500/7999	0	0	0	0	0	0	0	0	12	12
TOTAL	46	56	54	23	58	82	32	351	180	531
Percent by Vessel Size										
3000/3999	30%	34%	41%	0%	9%	20%	13%	23%	18%	21%
4000/4999	33%	32%	31%	39%	33%	10%	25%	27%	41%	31%
5000/5999	28%	25%	13%	43%	43%	41%	25%	32%	13%	25%
6000/6999	9%	5%	7%	0%	9%	27%	31%	14%	18%	15%
7000/7999	0%	4%	7%	17%	7%	2%	6%	5%	9%	7%

Source: Clarkson Research as of February 2002

As described in Table 13, as vessels increase in capacity, they also exhibit larger dimensions. In particular, the jump from Panamax to Post-Panamax vessels has increased design draft (or fully loaded conditions) from an average of 41 feet to 44 to 46 feet.

Table 13 – Fully Containerized Panamax and Post-Panamax Container Vessel Characteristics

	Avg. Size/Age					Average		Average		
	Nom	Hom		Dwt per	Average	Speed/Cons		Dimensions (ft.)		
Vessel Size	Teu	Teu	Dwt	Teu	Age	Knots	t/day	LOA	Beam	Draft
3000/3499 TEUS	3,229	2,505	45,180	14	11	21.7	95.3	820.3	105.6	39.0
3500/3999 TEUS	3,752	2,651	50,754	13.5	8.7	23.1	118.9	885.9	105.6	40.7
4000&+(Panamax)	4,331	3,217	60,490	14	6.3	23.5	141.7	945.9	105.6	42.3
Total Panamax	3,763	2,796	52,138	13.9	8.7	22.8	119.7	882.6	105.6	40.7
4000/4499 TEUS	4,199	3,331	59,647	14.3	8	24.1	154.5	895.7	124.0	44.3
4500/4999 TEUS	4,842	4,679	65,098	13.4	6.6	24.2	180.9	933.1	128.0	44.3
5000/5499 TEUS	5,281	4,120	67,167	12.7	3.9	25	201	915.7	131.2	44.9
5500/5999 TEUS	5,614	4,166	67,579	12	2.1	25.2	211.7	915.4	131.2	44.9
6000+ TEUS	6,619	5,601	88,005	13.3	2.6	24.6	209.4	1,034.8	136.2	45.9
Total Post-Panamax	5,610	4,463	72,291	12.9	3.7	24.7	196.6	948.5	131.6	44.9

Source: Clarkson Research as of February 2002

Container Fleet Serving U.S. West Coast

The U.S. West Coast trade route has been served in recent years by vessels ranging from 2,500 up to 6,000+ TEUS. As shown in Table 14, there were 524 vessel calls on the U.S. West Coast serving Trans-Pacific trade routes in 2001. Westbound cargo is the focus in this table because export containers typically weigh more than eastbound (import) containers, and are a key factor in channel deepening projects. The important findings of this table are:

- Sub-Panamax vessels accounted for 39% of the vessels deployed and 18% of the export tons/TEUS. These vessels are expected to decline in number, in favor of Panamax and post-Panamax vessels.
- Panamax vessels represented 43% of the vessels deployed and 40% of the tons/TEUS. These vessels (especially the larger Panamax vessels) are expected to continue to be an important part of the U.S. West Coast Trans-Pacific trade.
- Post-Panamax vessels (4,801 to 5,999 TEUS) accounted for 14% of the vessels deployed but carried 32% of tons and 32% of containers. Large post-Panamax vessels (6,000 TEUs or more) accounted for 4% of the vessels deployed but carried 11% of tons and 10% of containers. These vessels will also increase in importance on this trade route.

Table 14 – Summary of Vessel Deployment Characteristics on Westbound Trans-Pacific Trade Routes serving the U.S. West Coast

Vessel Type	# of Vessels	TEU Capacity	Avg. TEU Capacity	Total Westbound M. Tons	Total Westbound TEUs
Sub-Panamax	205	432,774	2,111	4,711,124	463,209
Panamax	225	851,324	3,784	10,187,511	1,032,918
Post-Panamax	75	398,526	5,314	8,040,613	817,927
Post-Panamax Large	19	129,863	6,835	2,730,017	266,460
Total	524	1,812,487	3,459	25,669,265	2,580,515
Percent of Fleet					
Sub-Panamax	39%	24%		18%	18%
Panamax	43%	47%		40%	40%
Post-Panamax	14%	22%		31%	32%
Post-Panamax Large	4%	7%		11%	10%
Grand Total	100%	100%		100%	100%

Source: Port of Portland using data from New York Journal of Commerce PIERS database

Container vessel dimensions are changing at the present time and are expected to continue to change throughout the study period. However, vessels in the 4,400 to 7,000 TEU range are expected to dominate the Trans-Pacific trades for the next 10 to 20 years.

In the longer term (15+ years out), some industry experts anticipate that vessels of 8,000 to 10,000 TEUS may become the standard in the major East-West trades. Most of these vessels are expected to be deployed on the Europe to Asia trade route but some could also be deployed on the Asia-U.S. West Coast trade route. Vessels beyond 10,000 TEUS have been

proposed but the main constraint appears to be a need for a new economical propulsion system to drive these proposed vessels. The future vessel could be longer and wider and marginally deeper. As Drewry Shipping Consultants points out, the 8,000 to 10,000 TEU vessels will have a design draft of approximately 47 to 48 feet.[2]

However, these larger vessels require consistent levels of containers and relatively high load factors to enable them to attain required economies of scale. The current downturn in liner trades has highlighted the inflexibility of the largest container ships and might encourage some lines to rethink their strategies. "In anything other than a growth market, more strings of smaller vessels seem much less risky – and therefore potentially less expensive – than fewer strings of bigger ships"[3].

There is uncertainty about whether vessels in the 8,000 to 10,000 TEU range will be deployed to the U.S. West Coast in significant number in the distant future. In addition, carriers will continue to have a distribution of their fleet to meet market conditions and provide flexibility. Therefore, vessels in the 4,000 to 7,000 TEU range will likely continue to operate on the U.S. West Coast throughout the study forecast period.

Impact of Container Vessel Size on Portland

The deployment of larger vessels began impacting Portland in 1995. As larger vessels came on line, an increasing percentage of the cargo in Portland's hinterland began to be diverted to Puget Sound ports. The constraints of the existing channel depth posed a constraint for carriers.

However, some carriers have chosen to maximize the amount of cargo that can be exported via Portland. For example, one operator is currently phasing out older Panamax vessels for newer 4,400-TEU vessels with a design draft of approximately 45 feet. This carrier has indicated that after consultation with the Columbia River pilots, they will set a limit of 38 feet in draft for vessels calling Portland, given current channel conditions. This will set a 2-foot[4] under-keel clearance allowing the vessels to sail on schedule under all water conditions, because schedule reliability is of paramount concern to liner operators.

Most West Coast container ports have (Los Angeles, Long Beach, Seattle, Tacoma and Vancouver BC) or are in the process of obtaining (Oakland) channel depths of 50+ feet of water depth under MLLW conditions. The Columbia River channel is currently limited to 40 feet with a proposed depth after deepening of 43 feet.

Container traffic in the Lower Columbia River is currently constrained by the existing channel dimensions and will also likely be constrained with an improved channel depth (43-feet). The forecasts provided in the following sections assume that Portland will gain market share in the first decade and then experience a decline in market share in the period 2010 through 2030 under with and without channel deepening.

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[2] Source: POST-PANAMAX: THE NEXT GENERATION by DREWRY SHIPPING CONSULTANTS LTD, August 2001, page 101.

[3] Source: Mark Paige, Drewry as reported in Fairplay Daily News, June 2002

[4] Using the LOADMAX model and under certain water conditions, it is possible that vessels sailing at 38 feet could have more than 2 feet of clearance in the existing channel.

Without Channel Deepening Project Supply-Constrained Container Forecast

Under the without channel deepening forecast, the cargo base in Portland's hinterland is expected to grow as depicted above in the supply constrained forecast. However, Portland's share of the market is expected to continue to decline. As shown in Table 15, Portland's market share of exports is expected to decline from 61% in 2000 to 50% in 2010, 40% in 2020 and 30% in 2030. Likewise, Portland's market share of imports is expected to decline from 40% in 2000 to 30% in 2010, 25% in 2020 and 20% in 2030.

Table 15 – Portland Capture of Local Trans-Pacific Market under Without Deepening Conditions (percent)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
2000	61%			40%			57%		
Forecast									
2010		50%	50%		30%	30%		45%	45%
2020		40%	40%		25%	25%		36%	36%
2030		30%	30%		20%	20%		27%	27%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

In addition, the intermodal market is also expected to decline under the constraints of the existing channel. Portland's export intermodal traffic is expected to decline from 8% of total Trans-Pacific traffic in 2000 to between 3% (low) and 6% (high) by 2030. Import intermodal traffic is expected to remain at 3% throughout the study period, which is higher than the 0% recorded in 2000 but lower than the levels in 1991 and 1995.

Table 16 – Portland Capture of Trans-Pacific Intermodal Market under Without Deepening Conditions (percent)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	15%			5%			14%		
1995	27%			7%			25%		
2000	8%			0%			7%		
Forecast									
2010		6%	8%		3%	3%		7%	13%
2020		5%	7%		3%	3%		8%	17%
2030		3%	6%		3%	3%		9%	17%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

The forecast for other trade routes (non Trans-Pacific routes) and the percent of empty containers are expected to be the same as under the supply-constrained forecast. The resulting total container forecast for full and empty containers on all trade routes is shown in Table 17.

Exports are expected to change from 219,200 TEUS in 2000 to between 191,800 TEUS (low) and 304,700 TEUS (high) by 2030. This represents average annual growth of –0.4% (low) and 1.1% (high).

Imports are expected to change from 69,000 TEUS in 2000 to between 96,000 TEUS (low) and 147,900 TEUS (high) by 2030. This represents average annual growth of 1.1% (low) and 2.6% (high).

Total cargo is expected to change from 288,100 TEUS in 2000 to between 287,800 TEUS (low) and 452,600 TEUS (high) by 2030. This represents average annual growth of 0.0% (low) and 1.5% (high).

Table 17 – Total Container Forecast on All Trade Routes under Without Project Conditions (1,000s of full & empty TEUS)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	117.3			55.8			173.2		
1992	149.3			61.6			210.9		
1993	171.6			66.3			237.9		
1994	217.1			94.2			311.4		
1995	221.2			99.9			321.1		
1996	202.7			100.5			303.2		
1997	183.6			105.4			289.0		
1998	176.7			81.0			257.8		
1999	198.7			84.2			282.9		
2000	219.2			69.0			288.1		
Forecast									
2010		223.5	258.7		63.4	72.4		286.9	331.1
2020		215.3	290.4		80.3	106.4		295.7	396.8
2030		191.8	304.7		96.0	147.9		287.8	452.6
Compound Annual Growth Rates									
1991-2000	7.2%			2.4%			5.8%		
2000-2010		0.2%	1.7%		-0.8%	0.5%		0.0%	1.4%
2010-2020		-0.4%	1.2%		2.4%	3.9%		0.3%	1.8%
2020-2030		-1.2%	0.5%		1.8%	3.3%		-0.3%	1.3%
2000-2030		-0.4%	1.1%		1.1%	2.6%		0.0%	1.5%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

With Deepening Project Supply-Constrained Container Forecast

Under the with deepening forecast, the cargo base in Portland's hinterland is expected to grow as depicted above in the supply constrained forecast. As shown in Table 18, Portland's market share of exports is expected to increase from 61% in 2000 to 68% in 2010, but then decline to 61% in 2020 and 55% in 2030. Likewise, Portland's market share of imports in the hinterland is expected to increase from 40% in 2000 to 45% in 2010, and then decline to 40% in 2020 and 35% in 2030.

Table 18 – Portland Capture of Local Trans-Pacific Market under With Deepening Conditions (%)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
2000	61%			40%			57%		
Forecast									
2010		68%	68%		45%	45%		63%	63%
2020		61%	61%		40%	40%		55%	55%
2030		55%	55%		35%	35%		49%	48%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

Portland's intermodal traffic is expected to increase under the deeper channel. Portland's intermodal exports are expected to increase as a percentage of Trans-Pacific trade from 8% in 2000 to 15% in 2010 and 20% in 2020/2030. Import intermodal traffic is expected to increase from 8% to 10% during the forecast period.

Table 19 – Portland Capture of Trans-Pacific Intermodal Market under With Deepening Conditions (%)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	15%			5%			14%		
1995	27%			7%			25%		
2000	8%			0%			7%		
Forecast									
2010		15%	15%		8%	8%		14%	14%
2020		20%	20%		9%	9%		18%	18%
2030		20%	20%		10%	10%		18%	18%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

The forecast for other trade routes (non Trans-Pacific routes) and percentage of empty containers are expected to be the same as under the supply-constrained forecast and without deepening condition. The resulting total container forecast for full and empty containers on all trade routes is shown in Table 20.

Exports are expected to change from 219,200 TEUS in 2000 to between 388,600 TEUS (low) and 601,200 TEUS (high) by 2030. This represents average annual growth of 1.9% (low) and 3.4% (high).

Imports are expected to change from 69,000 TEUS in 2000 to between 139,700 TEUS (low) and 226,500 TEUS (high) by 2030. This represents average annual growth of 2.4% (low) and 4.0% (high).

Total cargo is expected to change from 288,100 TEUS in 2000 to between 528,400 TEUS (low) and 827,700 TEUS (high) by 2030. This represents average annual growth of 2.0% (low) and 3.6% (high).

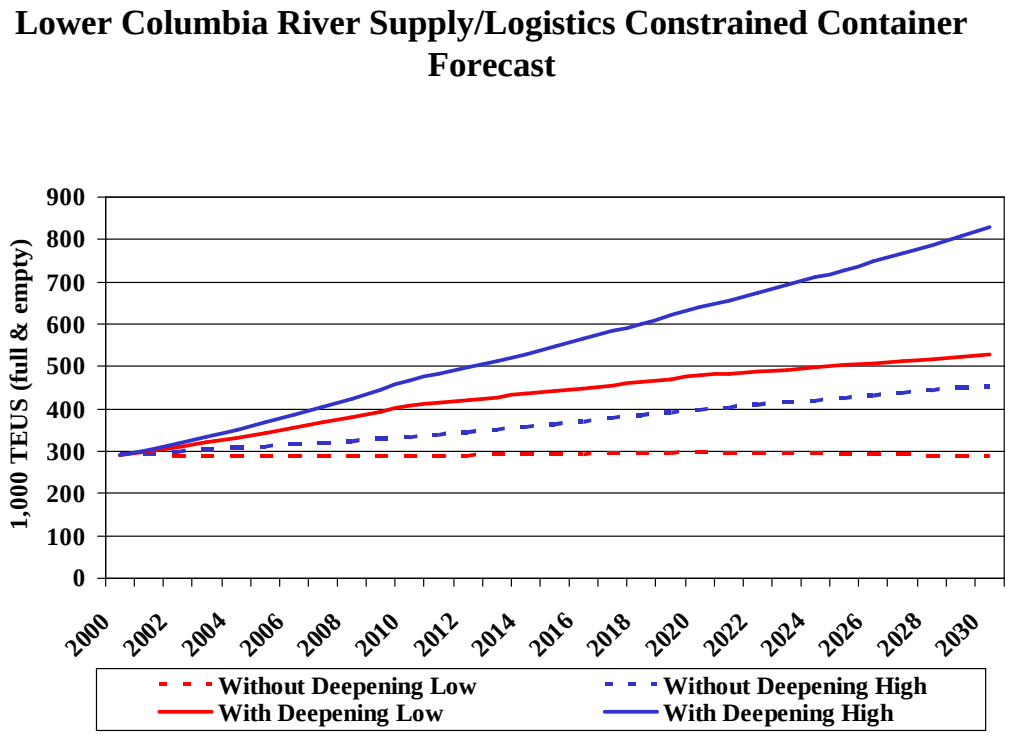
Table 20 – Total Container Forecast on All Trade Routes under With Project Conditions (1,000s of full & empty TEUS)

	Exports			Imports			Total		
		Forecast			Forecast			Forecast	
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1991	117.3			55.8			173.2		
1992	149.3			61.6			210.9		
1993	171.6			66.3			237.9		
1994	217.1			94.2			311.4		
1995	221.2			99.9			321.1		
1996	202.7			100.5			303.2		
1997	183.6			105.4			289.0		
1998	176.7			81.0			257.8		
1999	198.7			84.2			282.9		
2000	219.2			69.0			288.1		
Forecast									
2010		323.8	370.4		83.9	97.0		407.7	467.4
2020		368.0	489.0		111.0	151.4		478.9	640.4
2030		388.6	601.2		139.7	226.5		528.4	827.7
Compound Annual Growth Rates									
1991-2000	7.2%			2.4%			5.8%		
2000-2010		4.0%	5.4%		2.0%	3.5%		3.5%	5.0%
2010-2020		1.3%	2.8%		2.8%	4.6%		1.6%	3.2%
2020-2030		0.5%	2.1%		2.3%	4.1%		1.0%	2.6%
2000-2030		1.9%	3.4%		2.4%	4.0%		2.0%	3.6%

Source: Port of Portland historical data, forecasts by BST Associates, DRI-WEFA

The comparison of container forecasts under with and without deepening conditions is presented in Figure 8.

Figure 8 – Summary Comparison of Lower Columbia River Container Forecasts under with and without Project Conditions



BREAKBULK

Breakbulk cargo forecasts are presented in this section.

HISTORICAL TRENDS

First, historical trends of exports, imports and coastwise shipments are reviewed.

Exports

Breakbulk exports are dominated by forest products, especially newsprint, lumber and wood pulp, among other products. Breakbulk exports have been declining significantly in recent years due both to containerization and also loss of markets overseas, particularly as a result of the aftermath of the Asian Financial crisis and the continued strength of the U.S. dollar.

Table 21 – Breakbulk Trends – Exports (1,000s of Metric Tons)

Commodity	1997	1998	1999	2000
Wood Products	131.2	43.9	33.8	24.6
Machinery & Equipment	4.1	0.4	2.3	12.6
Metals, Other	10.3	-	18.7	3.6
Paper Prds	348.8	344.7	310.9	316.4
Steel	2.1	9.3	1.1	0.5
Wood Pulp	101.9	92.4	110.8	96.7
Other	1.8	6.6	9.4	20.0
Subtotal	600.1	497.3	486.9	474.6

Source: BST Associates, using MARAD data

Imports

Breakbulk imports are dominated by steel product imports, which accounted for 89% of breakbulk imports in 2000. Other products include forest products and other miscellaneous products.

Table 22 – Breakbulk Trends – Imports (1,000s of Metric Tons)

Commodity	1997	1998	1999	2000
Wood Products	79.3	76.0	73.5	76.9
Machinery & Equipment	0.2	5.8	2.3	9.7
Steel	347.5	758.9	1,033.9	970.3
Wood Pulp	51.6	22.9	22.3	24.5
Other	4.8	21.8	5.5	10.7
Subtotal	483.4	885.4	1,137.4	1,092.1

Source: BST Associates, using MARAD data

Coastwise Shipments

Some forest products (notably lumber and paper products) are shipped from Lower Columbia River ports/mills in coastwise service to Southern California. Volumes declined consistently from 1990 to 1997 but have since rebounded, and stand at 203,000 tons in 2000.

During this period, coastwise breakbulk shipments declined at an average annual rate of –2.7%.

Table 23 – Breakbulk Coastwise Shipments

Year	Lumber	Paper Prds	Total
1990	248.6	20.0	268.6
1995	109.8	21.0	130.8
2000	190.9	12.3	203.3
Compound Annual Growth Rate			
1990-2000	-2.6%	-4.7%	-2.7%

Source: BST Associates, using USACE data

FORECASTS

Forecasts of breakbulk cargoes by direction and service are provided below.

Exports

Breakbulk exports are projected to change from approximately 475,000 tons in 2000 to between 404,100 tons (low) and 595,700 tons (high) by 2030, representing average annual growth of -0.5% (low) and 0.8% (high).

Table 24 – Breakbulk Export Forecasts (1,000 Metric Tons)

	Wood Products		Machinery & Equipment		Paper Prds		Wood Pulp		Other		Total	
Year	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
2000 Actual	24.6		12.6		316.4		96.7		24.22		474.6	
Forecast												
2010	22.2	28.6	12.0	15.6	297.9	316.4	92.0	97.7	23.0	24.2	447.2	482.5
2020	21.1	33.2	11.2	19.7	277.7	364.1	88.8	111.8	22.4	24.2	421.3	553.1
2030	21.1	35.9	11.8	22.4	266.8	392.8	82.8	120.4	21.5	24.2	404.1	595.7
Compound Annual Growth Rates												
2000-2010	-1.0%	1.5%	-0.5%	2.1%	-0.6%	0.0%	-0.5%	0.1%	-0.5%	0.0%	-0.6%	0.2%
2010-2020	-0.5%	1.5%	-0.7%	2.4%	-0.7%	1.4%	-0.4%	1.4%	-0.3%	0.0%	-0.6%	1.4%
2020-2030	0.0%	0.8%	0.5%	1.3%	-0.4%	0.8%	-0.7%	0.7%	-0.4%	0.0%	-0.4%	0.7%
2000-2030	-0.5%	1.3%	-0.2%	1.9%	-0.6%	0.7%	-0.5%	0.7%	-0.4%	0.0%	-0.5%	0.8%

Source: BST Associates, DRI-WEFA

Imports

Breakbulk imports are projected to increase from approximately 1.1 million tons in 2000 to between 1.1 million tons (low) and 1.8 million tons (high) million tons by 2030, representing average annual growth of 0.2% (low) and 1.8% (high).

Table 25 – Breakbulk Import Forecasts (1,000 Metric Tons)

	Wood Products		Machinery & Equipment		Steel Prds		Wood Pulp		Other		Total	
Year	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
2000 Actual	76.9		9.7		970.3		24.5		10.69		1,092.1	
Forecast												
2010	89.8	99.7	10.6	11.0	988.7	1,160.7	24.5	25.4	10.7	10.7	1,124.2	1,307.5
2020	101.9	127.2	11.5	12.4	1,021.7	1,449.8	25.5	28.1	10.7	10.7	1,171.3	1,628.3
2030	108.0	144.5	11.9	13.3	990.9	1,645.3	26.0	28.8	10.7	10.7	1,147.5	1,842.5
Compound Annual Growth Rates												
2000-2010	1.6%	2.6%	0.8%	1.2%	0.2%	1.8%	0.0%	0.4%	0.0%	0.0%	0.3%	1.8%
2010-2020	1.3%	2.5%	0.8%	1.2%	0.3%	2.2%	0.4%	1.0%	0.0%	0.0%	0.4%	2.2%
2020-2030	0.6%	1.3%	0.4%	0.7%	-0.3%	1.3%	0.2%	0.2%	0.0%	0.0%	-0.2%	1.2%
2000-2030	1.1%	2.1%	0.7%	1.0%	0.1%	1.8%	0.2%	0.5%	0.0%	0.0%	0.2%	1.8%

Source: BST Associates, DRI-WEFA

Coastwise Shipments

Breakbulk coastwise shipments are projected to change from approximately 203,000 tons in 2000 to between 174,500 tons (low) and 237,500 tons (high), representing average annual growth of -0.5% (low) and +0.5% (high).

Table 26 – Breakbulk Coastwise Shipment Forecasts (1,000 Metric Tons)

	Lumber		Paper Prds		Total	
Year	Low	High	Low	High	Low	High
2000	190.9		12.3		203.3	
Forecast						
2010	181.6	200.7	11.5	12.8	193.1	213.5
2020	174.5	215.2	10.9	13.2	185.4	228.4
2030	164.3	224.0	10.2	13.5	174.5	237.5
Compound Annual Growth Rates						
2000-2010	-0.5%	0.5%	-0.7%	0.4%	0.2%	1.8%
2010-2020	-0.4%	0.7%	-0.5%	0.3%	0.3%	2.2%
2020-2030	-0.6%	0.4%	-0.7%	0.2%	-0.3%	1.3%
2000-2030	-0.5%	0.5%	-0.6%	0.3%	-0.5%	0.5%

Source: BST Associates, DRI-WEFA

AUTOS

This section provides forecasts for fully assembled autos and trucks.

HISTORICAL TRENDS

Imports of fully assembled autos/trucks via U.S. West Coast ports grew rapidly from 1982 to 1986 then continued a long downhill slide until 1996. Since then, imports have increased rapidly and have again reached the previous peak established in 1986.

The Lower Columbia region experienced average annual growth in fully assembled autos/trucks as follows:

- Imports (in units) grew at 7.9% per year between 1993 and 2000. Volumes declined in the first five years of the decade and then increased rapidly during the last five years of the decade.
- Exports declined at –15.4% per year over the period 1993 to 2000, growing in a converse relationship with imports (up through 1995 and then declining through 2000). The strength of the U.S. dollar increased imports and depressed exports.

Table 27 – Historical Trends of Fully Assembled Autos/Trucks via Lower Columbia River Ports (Tons, Units)

	Units			Metric Tons		
Year	**Total**	**Import**	**Export**	**Total**	**Import**	**Export**
1993	258,629	226,730	31,899	376,079	339,257	36,822
1994	314,474	258,535	55,939	404,563	335,104	69,459
1995	245,659	191,450	54,210	259,373	207,962	51,411
1996	219,173	174,559	44,614	311,888	256,002	55,886
1997	290,191	260,111	30,080	404,302	372,850	31,452
1998	283,187	264,301	18,886	411,033	387,160	23,873
1999	353,779	336,196	17,583	490,138	468,407	21,731
2000	397,140	387,240	9,900	533,349	523,439	9,911
Compound Annual Growth Rates						
1993-2000	6.3%	7.9%	-15.4%	5.1%	6.4%	-17.1%
1996-2000	16.0%	22.0%	-31.4%	14.4%	19.6%	-35.1%

Source: BST Associates, using data from Port of Portland, Maritime Administration, and PMA

MARKET SHARE

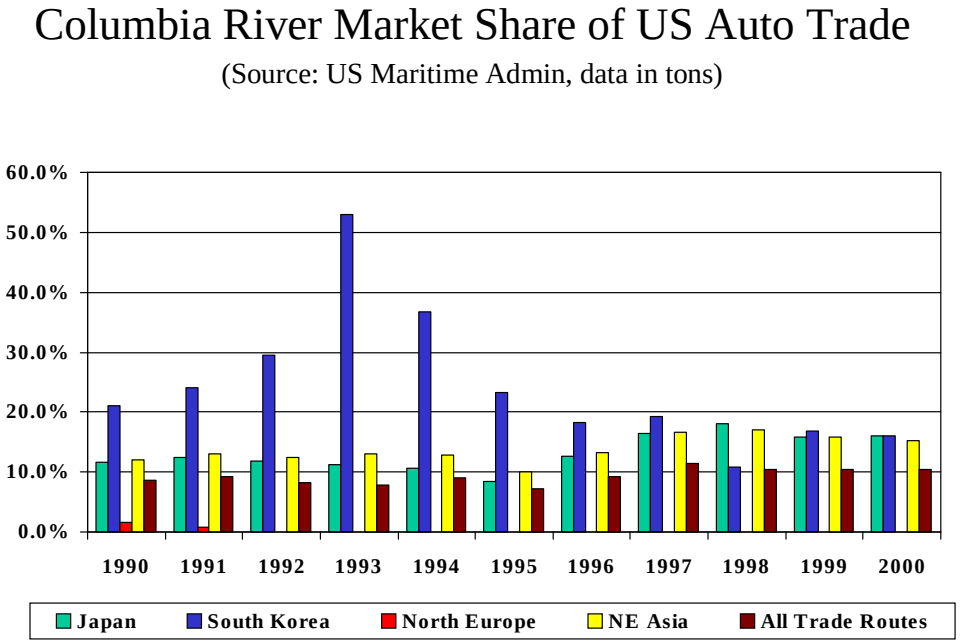
The region experienced changes in market share by trading partner, as follows:

- Japan – the Columbia River region increased from 11.6% of U.S. imports from Japan in 1990 to 16.0% in 2000 relative to all U.S. ports. Japanese imports of autos to the U.S. have remained relatively constant (changing from 2.77 million metric tons in 1990 to 2.68 million metric tons in 2000).
- South Korea – the Columbia River region declined from 21.0% in 1990 to 16.0% in 2000 relative to all U.S. ports. South Korean imports of autos to the U.S. have

increased dramatically (growing from 185,892 metric tons in 1990 to 721,053 metric tons in 2000).

- Columbia River ports increased market share of NE Asia imports (Japan, Korea and Taiwan) from 11.6% in 1990 to a peak of 18.0% in 1998 and then experienced a slight decline to 16.0% in 2000.
- Most other imports come from Europe, which have experienced very rapid growth in the U.S. (i.e., from 619,305 metric tons in 1990 to 1,403,991 metric tons in 2000). However, the Lower Columbia region now has little of this business. Canadian imports used to move by water in the early 1990s but now mainly move via rail.

Figure 9 – Columbia River Market Share of U.S. Auto Imports



FORECAST OF FULLY ASSEMBLED AUTOS/TRUCKS

The Lower Columbia region is expected to import between 369,000 (low) and 561,000 (high) units by the year 2030, representing annualized growth of between -0.2% (low) and 1.2% (high). The high forecast assumes that a new account moves to the area.

Exports of fully assembled autos/trucks are expected to reach between 13,000 (low) and 19,000 (high) units by the year 2010, representing annualized growth of 0.9% to 2.2%.

The combined forecast (imports and exports) projects between 382,000 (low) and 580,000 (high) units by the year 2010.

Table 28 – Auto Forecast - Import & Export Metric Tons (Units and Metric Tons)

	Units								
	Imports			Exports			Total		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1993	226,730			31,899			258,629		
2000	387,240			9,900			397,140		
Forecast									
2010		378,000	531,000		11,000	13,000		389,000	544,000
2020		369,000	518,000		12,000	17,000		381,000	535,000
2030		369,000	561,000		13,000	19,000		382,000	580,000
Compound Annual Growth Rates									
1993-2000	7.9%			-15.4%			6.3%		
2000-2010		-0.3%	3.2%		1.3%	2.9%		-0.2%	3.2%
2010-2020		-0.3%	-0.3%		1.0%	2.9%		-0.2%	-0.2%
2020-2030		0.0%	0.8%		0.9%	1.1%		0.0%	0.8%
2000-2030		-0.2%	1.2%		0.9%	2.2%		-0.1%	1.3%
	Metric Tons								
	Imports			Exports			Total		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1993	339,257			36,822			376,079		
2000	523,439			9,911			533,349		
Forecast									
2010		510,000	717,000		11,000	13,000		521,000	730,000
2020		497,000	699,000		12,000	17,000		509,000	716,000
2030		497,000	757,000		13,000	19,000		510,000	776,000
Compound Annual Growth Rates									
1993-2000	6.4%			-17.1%			5.1%		
2000-2010		-0.3%	3.2%		1.0%	2.8%		-0.2%	3.2%
2010-2020		-0.3%	-0.3%		0.9%	2.7%		-0.2%	-0.2%
2020-2030		0.0%	0.8%		0.8%	1.1%		0.0%	0.8%
2000-2030		-0.2%	1.2%		0.9%	2.2%		-0.1%	1.3%

Source: BST Associates, DRI-WEFA

LOGS

The following section provides forecasts for log exports, imports and domestic receipts.

HISTORICAL TRENDS

Shipments (Exports and Coastwise Shipments)

Log exports via Lower Columbia River ports declined from 3.3 million tons in 1993/1994 to 1.3 million metric tons in 2001, which corresponds to a decline of –7.7% per year. Exports via Astoria and Portland disappeared. Now all log exports move via the Weyerhaeuser and Public Facilities in Longview. However, exports via the U.S. West Coast fell at an even faster rate and hence, the Columbia River's market share increased from 27% in 1990 to 54% in 2001.

Table 29 – Log Exports (Metric Tons)

	Columbia River Ports					LCR % of US
Year	Astoria	Longview	Portland	subtotal	West Coast	West Coast
1990	465,962	2,677,392	164,079	3,307,433	12,248,042	27.0%
1991	382,110	2,650,432	251,707	3,284,249	10,740,401	30.6%
1992	253,181	2,303,646	220,816	2,777,643	9,119,062	30.5%
1993	192,790	2,059,100	162,046	2,413,936	6,842,796	35.3%
1994	162,209	2,109,697	141,903	2,413,809	6,612,346	36.5%
1995	111,400	1,895,144	103,219	2,109,762	6,050,000	34.9%
1996	36,888	2,005,948	102,312	2,145,148	5,967,352	35.9%
1997	-	1,685,489	35,553	1,721,043	4,472,746	38.5%
1998	-	1,466,862	-	1,466,862	3,519,777	41.7%
1999	-	1,464,086	-	1,464,086	3,315,871	44.2%
2000	-	1,554,772	-	1,554,772	3,292,463	47.2%
2001	-	1,362,063	-	1,362,063	2,541,616	53.6%
Compound Annual Growth Rates						
1990-	-	-6.0%	-100.0%	-7.7%	-13.3%	6.4%

Source: BST Associates using data from Jones Stevedore Company

There have also been intermittent coastwise shipments of logs out of the Columbia River (reaching a high volume of 19,000 tons in 1999).

Receipts

Lower Columbia River ports and/or mills also receive logs from domestic and foreign (mainly Canadian) producers. Coastwise receipts from Washington State reached a peak of 220,000 tons in 1998 before falling to 60,000 tons in 2000. Imports from Canadian companies were 30,000 tons in 2000.

FORECASTS

Forecasts for receipts and shipments of logs are provided in this section.

Shipments

Log shipments are expected to decline from 1.6 million metric tons in 2000 to approximately 1.0 million metric tons in 2030 under the low scenario forecast. Under the high scenario forecast, log shipments could remain at approximately 1.6 million metric tons. These movements are dominated by exports.

Table 30 – Log Shipment Forecasts (Millions of Metric Tons)

	Coastwise Shipments			Exports			Total Outbound		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
1990	-			3.31			3.3		
2000	0.01			1.55			1.6		
Forecast									
2010		0.01	0.01		1.32	1.63		1.33	1.64
2020		0.01	0.01		1.15	1.63		1.16	1.64
2030		0.00	0.01		0.98	1.63		0.98	1.64
Compound Annual Growth Rates									
1990-2000	NM			-7.3%			-7.2%		
2000-2010		-1.5%	-1.1%		-1.6%	0.5%		-1.6%	0.5%
2010-2020		-1.3%	-0.5%		-1.4%	0.0%		-1.4%	0.0%
2020-2030		-1.6%	-0.5%		-1.6%	0.0%		-1.6%	0.0%
2000-2030		-1.5%	-0.7%		-1.5%	0.2%		-1.5%	0.2%

Source: BST Associates, DRI-WEFA

Receipts

Log receipts are expected to increase from 180,000 metric tons in 2000 to between 250,000 and 320,000 tons in 2030 under the low and high scenario forecast, respectively.

Table 31 – Log Receipt Forecasts (Millions of Metric Tons)

	Coastwise Receipts			Imports			Total Inbound		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
Avg 97-00	0.16			0.02			0.18		
Forecast									
2010		0.18	0.20		0.03	0.03		0.21	0.23
2020		0.21	0.26		0.03	0.04		0.24	0.30
2030		0.22	0.28		0.03	0.04		0.25	0.32
Compound Annual Growth Rates									
2000-2010		1.5%	2.5%		2.3%	3.3%		1.6%	2.6%
2010-2020		1.5%	2.6%		1.5%	2.6%		1.5%	2.6%
2020-2030		0.3%	0.9%		0.3%	0.9%		0.3%	0.9%
2000-2030		1.1%	2.0%		1.4%	2.3%		1.1%	2.0%

Source: BST Associates, DRI-WEFA

GRAIN

The following section provides forecasts for grain and related products that move via Columbia River export elevators.

SUPPLY-CONSTRAINED FORECASTS

The following section focuses on supply-constrained forecasts, taking into account acres in production, harvest, net trade and market share for the Lower Columbia River. This section is followed by forecasts taking the proposed channel deepening into consideration.

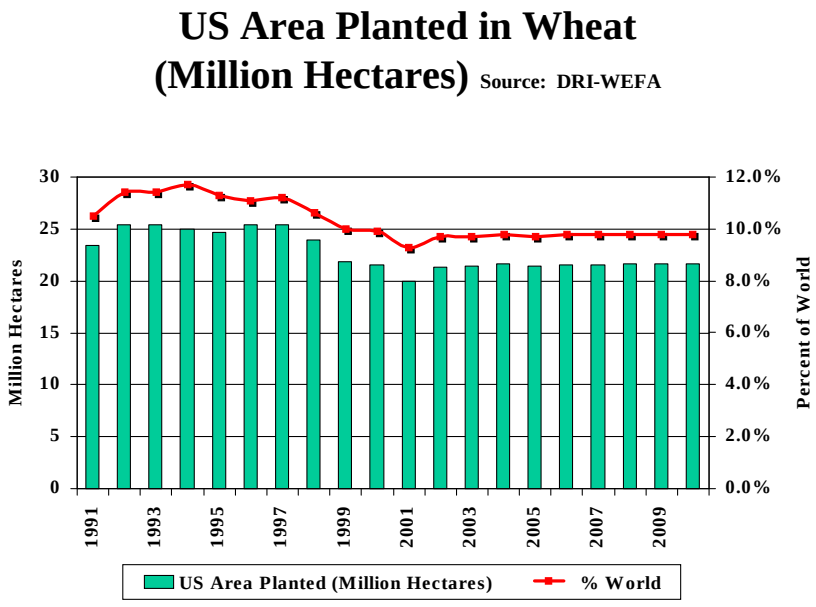
Wheat Export Forecasts

Wheat export forecasts via Lower Columbia River ports are presented below.

Acres in Wheat Production

U.S. acreage in wheat production is expected to decline from approximately 25 million hectares in the 1990s to slightly more than 21 million hectares in the period 2000 to 2010 and likely remain relatively stable at this level in the future. U.S. acreage in wheat production is expected to decline from approximately 11% to 12% of world acreage in wheat production during the 1990s to less than 10% in the forecast period.

Figure 10 – U.S. Area Planted in Wheat



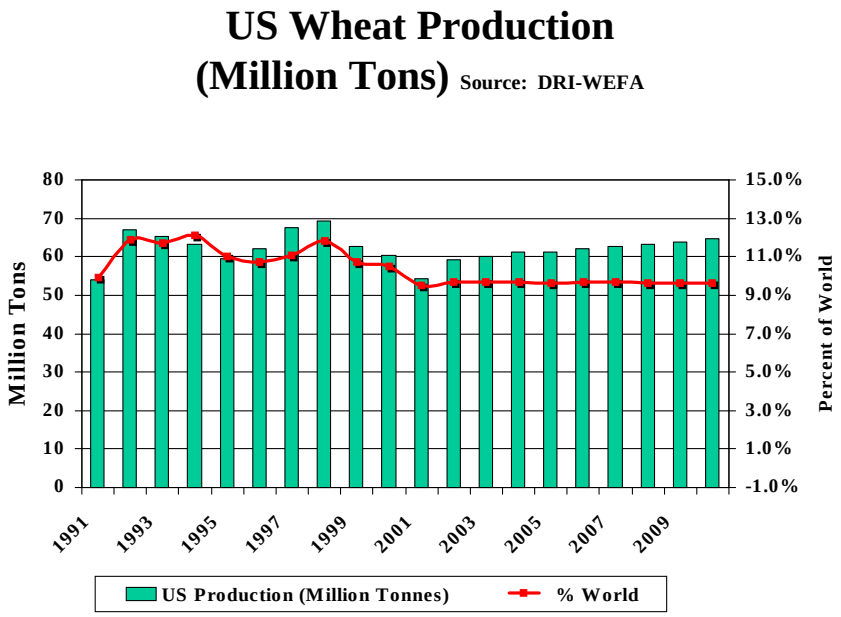
Wheat Production

During the period 2001 through 2010, DRI-WEFA projects that world wheat production will increase from 568 million metric tons (mmt) to 674 mmt, representing an increase of 106 mmt. The additional production is projected to occur in:

- China (25.9 mmt),
- European Union (24.4 mmt),
- India (14.3 mmt),
- U.S. (10.4 mmt),
- Canada (7.5 mmt),
- Argentina (5.3 mmt),
- Australia (4.1 mmt),
- Former Soviet Union (3.7 mmt), and,
- Other producers will account for the remaining 10.2 mmt.

U.S. wheat production, which ranged from 54 to 67 mmt in the 1990s, is expected to increase slightly from 60 to 65 mmt between 2002 and 2010, or at an average annual growth of approximately 1.1% during the period 2002 to 2010.

Figure 11 – U.S. Wheat Production



World Wheat Trade

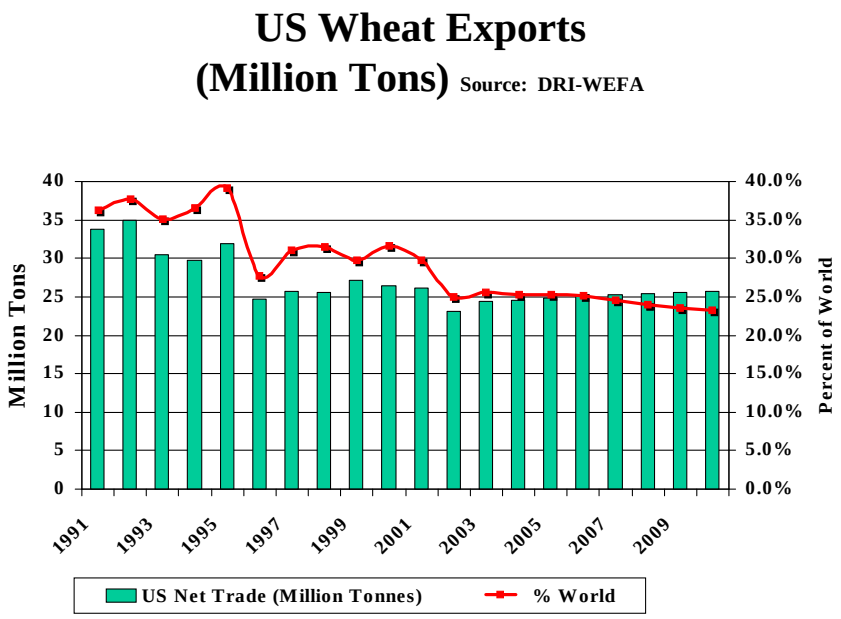
The areas of expanding import demand are expected to continue to be the traditional regions of:

- Africa (increasing net imports from 24.1 mmt in 2000 to 27.5 mmt in 2010),

- The Middle East (increasing net imports from 15.9 mmt in 2000 to 23.4 mmt in 2010), and,
- Asia
    - China is expected to increase net imports to 1.6 mmt in 2010, after having been an net exporter for several prior years,
    - Japan is expected to be a stable importer at 5.2 to 5.3 mmt during the decade,
    - Rapidly developing Asia (S.E. Asia) is expected to increase net imports from 9.7 mmt in 2000 to 13.6 mmt in 2010, and,
    - Other Asia (primarily Pakistan and Bangladesh) is expected to increase net imports from 6.8 mmt in 2000 to 11.4 mmt in 2010.

Increasing food demand resulting from population growth and income growth will be the long-term drivers for increasing wheat imports into these regions. Similar to the demand for meats, the demand for processed wheat products grows, as income levels increase. Domestic consumption of wheat in China and India is projected to grow by 41 million metric tons over the next 15 years, of which nearly 9.4 million metric tons is expected to be supplied by other countries. Domestic consumption of wheat also continues to grow in Asia, the Middle East, and Africa.

Figure 12 – U.S. Net Wheat Trade



The European Union is expected to capture nearly 2/3 of the expansion in the wheat market, due primarily to the EU being able to export wheat without subsidies by 2006. The European Union will expand exports from 8 mmt this year to over 20mmt by the end of the forecast. Other exporters expected to increase wheat exports include Argentina, Australia,

and Canada. The devaluation projected for Argentina will increase the competitiveness of Argentine wheat in the world market. Canada's market share is also expected to increase. Significantly, the United States is expected to exhibit relatively flat export growth of wheat over the forecast period due to the increased competition from Argentina and Canada. U.S. wheat exports are expected to average approximately 25 million tons in the forecast period, with U.S. market share of world wheat trade declining from between 25% and 40% in the period of the 1990s to 25% or less in the forecast period.

Columbia River Wheat Export Forecast

The Columbia River region averaged a market share of 38.5% of U.S. wheat exports in the period 1990 to 2000. However, during the most recent period (1995 to 2000), Columbia River port market share of wheat exports increased to 40.0%. Most other U.S. wheat exports originate in Kansas and move via the Gulf Coast (49.9% in the period 1995 to 2000). Approximately 7% also moves via the Great Lakes (up from 6.1% in the period 1990 to 2000) with smaller volumes also move via other port regions.

Drought conditions in concert with the lingering effects of the Asian Financial Crisis brought wheat export volumes to historically low levels in 2000. Columbia River wheat exports are projected to range between 9.8 mmt and 15.0 mmt in 2030, or at annual growth rates ranging from –0.5% to 1.3% per year.

Table 32 – Columbia River Wheat Export Forecast (Millions of Metric Tons)

		Forecast	
Year	**Actual**	**Low**	**High**
1991	11.0		
1992	11.4		
1993	11.1		
1994	13.9		
1995	13.5		
1996	12.6		
1997	11.3		
1998	11.1		
1999	10.5		
2000	10.2		
2010		10.1	12.2
2020		9.7	13.6
2030		9.8	15.0
Compound Annual Growth Rates			
1991-0200	-0.8%		
2000-2010		-1.0%	1.8%
2010-2020		-0.5%	1.1%
2020-2030		0.1%	0.9%
2000-2030		-0.5%	1.3%

Source: BST Associates, DRI-WEFA

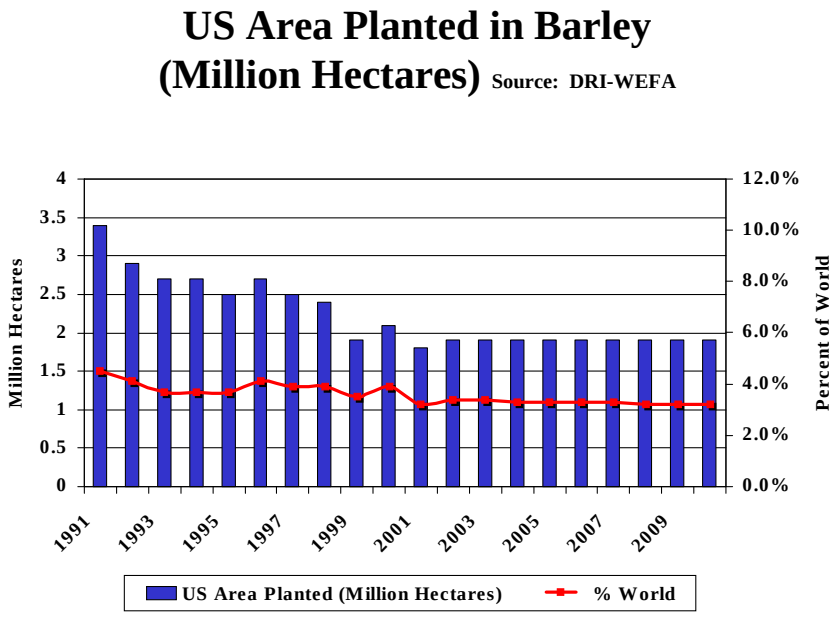
Barley Export Forecasts

The following section provides forecasts for barley exports via Lower Columbia River ports.

Acres in Barley Production

U.S. acreage in barley production is expected to decline from a high of 3.4 million hectares in 1991 to 1.8 to 1.9 million hectares in the period 2000 to 2010. U.S. acreage in barley production is expected to decline from a high of 4.5% of world acreage in barley production (in 1991) to approximately 3.2% throughout the forecast period to 2010.

Figure 13 – U.S. Area Planted in Barley



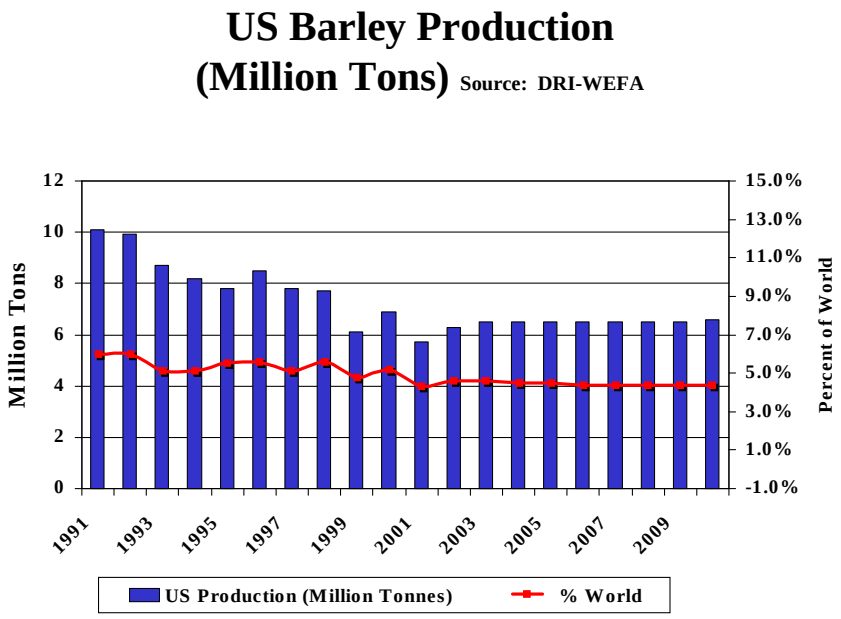
Barley Production

During the period 2001 through 2010, DRI-WEFA projects that world barley production will increase from 132 mmt to 151 mmt, representing an increase of 19 mmt. The additional production is projected to occur in:

- European Union (7.0 mmt),
- Canada (3.1 mmt),
- Former Soviet Union (2.6 mmt),
- Australia (1.2 mmt),
- Middle East (1.2 mmt),
- U.S. (0.9 mmt), and,
- Other producers will account for the remaining 2.9 mmt.

U.S. barley production, which declined from 10.0 mmt in 1991 to a low of 6.1 mmt in 1999, is expected to grow modestly from 5.7 mmt in 2001 to 6.6 mmt in 2010, or at an average annual growth of approximately 0.5% during the period 2002 to 2010.

Figure 14 – U.S. Barley Production



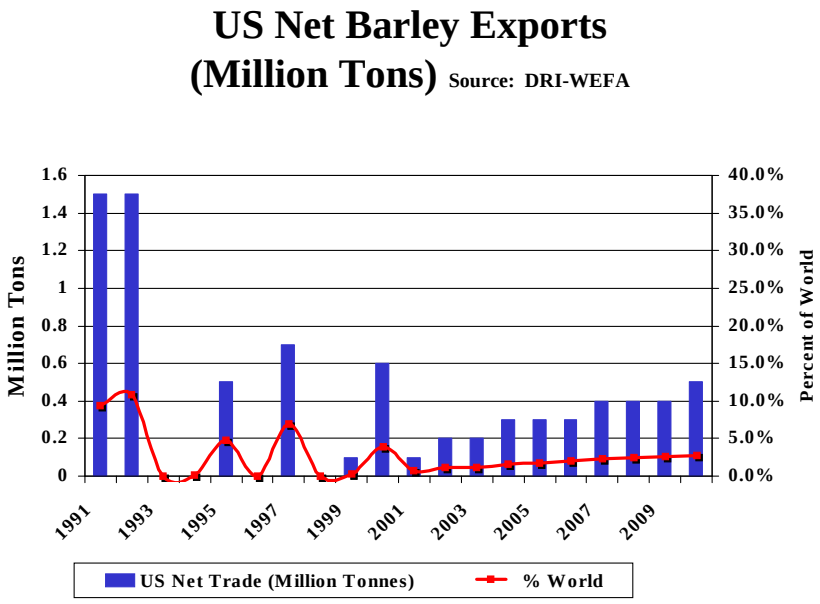
World Barley Trade

The Former Soviet Union is expected to remain the world's largest barley importer, increasing net imports by 3.5 mmt between 2000 and 2010. Other net importers are only expected to marginally increase imports. In particular, the traditional importers of U.S. barley are expected to have stable or slightly increasing imports during the study period:

- China is expected to increase its imports of barley from 2.2 mmt in 2000 to 2.6 mmt in 2010,
- Japanese barley imports are expected to remain relatively stable at 1.5 mmt per year,
- Rapidly developing Asia (S.E. Asia) is expected to remain stable at 0.3 mmt per year, and,
- Other Asia (primarily Pakistan and Bangladesh) is expected to marginally decrease net imports during the forecast period.

As a result, net U.S. barley exports are expected to remain at relatively low levels, between 200,000 and 450,000 tons through 2010, which is much lower than historical levels. However, it should be emphasized that the U.S. also imports barley (primarily from Canada). The volume of barley exports by water is projected to increase from 1.0 mmt in 2002 to 1.3 mmt in 2010.

Figure 15 – U.S. Net Barley Trade



Columbia River Barley Export Forecast

The Columbia River averaged 41% of U.S. barley exports in the period 1990 to 2000 but this increased to nearly 58% in the period 1995 to 2000. Most of the other barley exports move via Gulf Coast ports (6.4% in the period 1995 to 2000) or Great Lakes (14.9% in the same period).

As shown in Table 33, Columbia River barley exports are projected to reach between 400,000 tons (low) and 900,000 tons (high) in 2030, with annual growth ranging from –1.8% (low) to 1.0% (high).

Table 33 – Columbia River Barley Export Forecast (Millions of Metric Tons)

		Forecast	
Year	**Actual**	**Low**	**High**
1991	0.5		
1992	0.3		
1993	0.3		
1994	0.1		
1995	0.8		
1996	0.4		
1997	0.6		
1998	0.3		
1999	0.3		
2000	0.7		
2010		0.4	0.8
2020		0.4	0.9
2030		0.4	0.9
Compound Annual Growth Rates			
1991-2000	-4.2%		
2000-2010		-4.8%	2.2%
2010-2020		-0.6%	0.3%
2020-2030		-0.1%	0.4%
2000-2030		-1.8%	1.0%

Source: BST Associates, DRI-WEFA

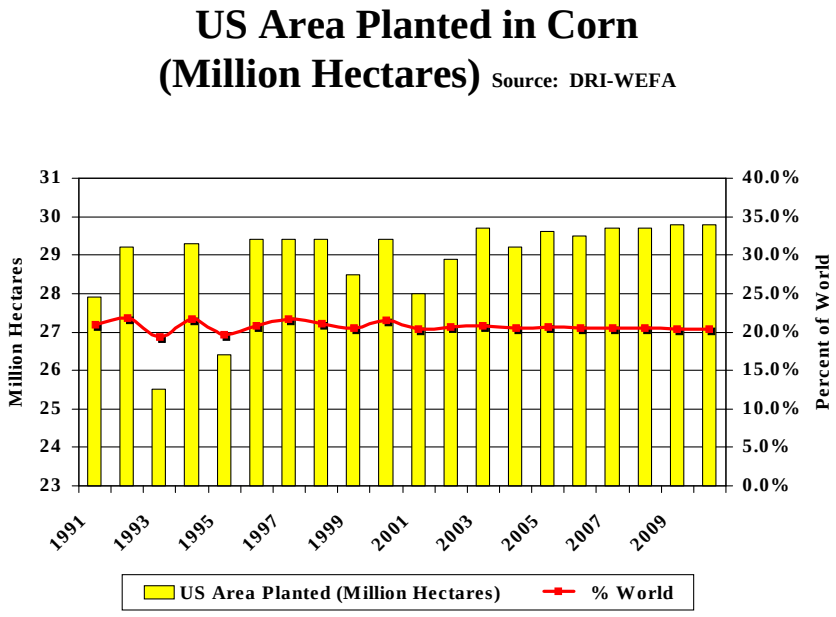
Corn Export Forecasts

The following section provides forecasts for corn exports via Lower Columbia River ports.

Acres in Corn Production

U.S. acreage in corn production is expected to grow modestly from 28 million hectares in 2001 to nearly 30 million hectares by 2010. U.S. acreage in corn production is expected to decline slightly from 21.5% in 2000 to 20.4% of world acreage in 2010.

Figure 16 – U.S. Area Planted in Corn



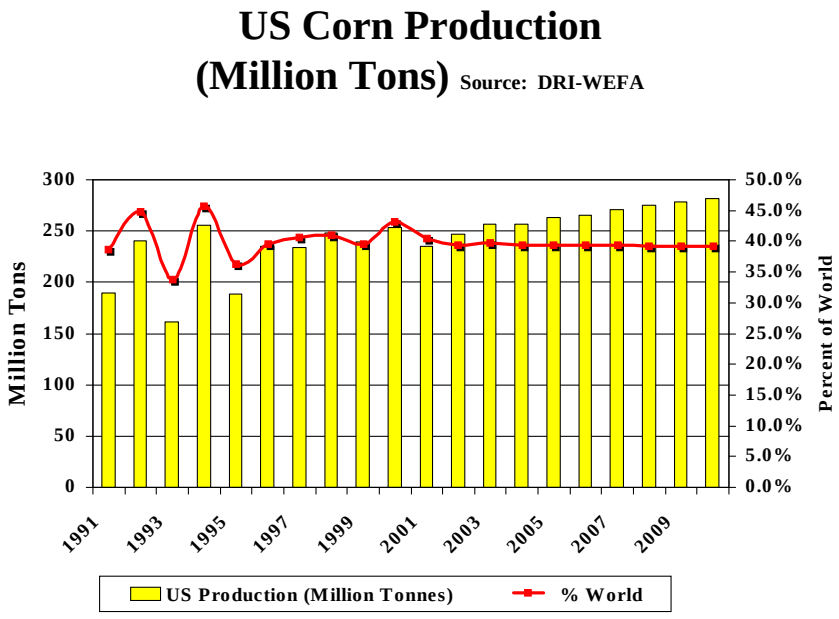
Corn Production

During the period 2001 through 2010, DRI-WEFA projects that world corn production will increase from 580 mmt to 721 mmt, representing an increase of 141 mmt. The additional production is projected to occur in:

- U.S. (46.9 mmt),
- China (43.2 mmt),
- Argentina (9.3 mmt),
- Brazil (8.0 mmt),
- Eastern Europe (7.4 mmt),
- Canada (1.6 mmt),
- Africa (6.8 mmt), and,
- Other producers will account for the remaining 18.0 mmt.

The U.S. is expected to continue to be the world's largest corn producer throughout the study period. U.S. corn production is expected to increase from 247 mmt in 2002 to 282 mmt in 2010, or at 1.7% per year. In the United States, area in corn expands modestly, with most of the production expansion coming from robust yield growth.

Figure 17 – U.S. Corn Production



World Corn Trade

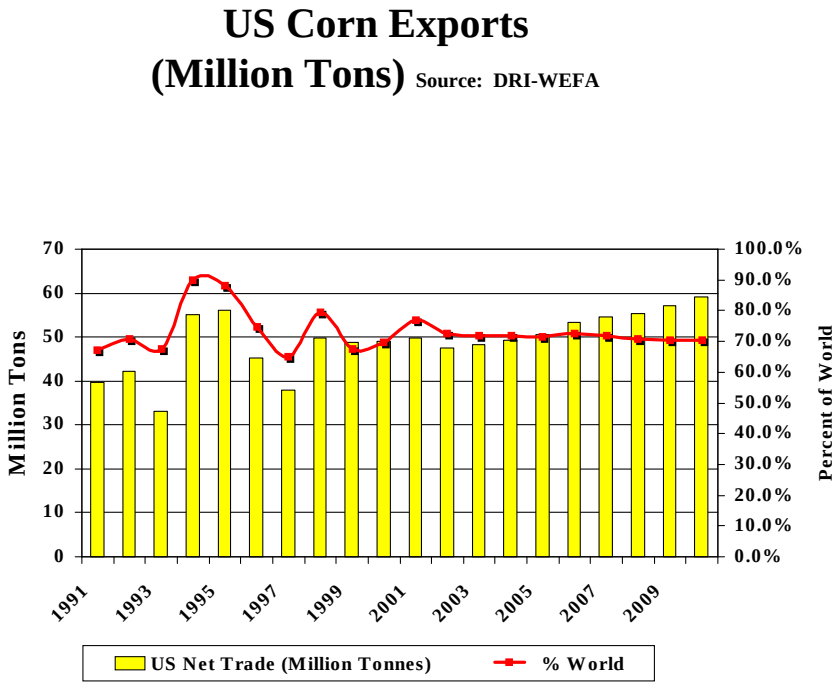
Along with China and Brazil, Other Latin America, Egypt, Taiwan, Korea, India, and Mexico will be significantly increasing their corn imports over the forecast period. For each of the regions, the import growth is driven by increases in feed demand. Assuming a general global recovery by 2004, meat consumption will increase as incomes grow. Despite some feed grain production growth in these countries, especially in India and Mexico, input constraints would likely force all of these countries to increase corn imports substantially. Corn import growth in Egypt and Mexico will be fueled by food demand as well as feed demand.

The specific livestock sectors driving global corn feed demand vary, depending on the country. In China, the primary livestock sector pushing feed demand continues to be pork, although small changes toward more diversified meat preferences are beginning to be seen. An important factor compelling China's rising corn imports is the adoption of different feed technologies. Part of China's livestock production is described as "backyard" production, in contrast to the "commercial" production common in the Western hemisphere. Much of the expansion of the livestock sector occurring in Southern China is commercial production. In addition to simply expanding the number of animals being fed, these commercial operations

are using rations that more closely resemble Western rations, which include a balance of corn and soybean meal. Subsequently, robust growth in feed demand is expected to make China become a net importer of corn by 2006, increasing to 8.5 MMT by 2010.

Brazil continues to pursue its objective of being the number one poultry exporter in the world, and subsequently, the poultry sector is driving much of the corn feed demand. The Brazilian pork sector also contributes to the expansion in corn feed demand, as pork production expands from present levels by nearly 50% by 2010.

Figure 18 – U.S. Net Corn Trade



India has an area enormous potential for feed demand growth, given income and population growth. However, due to their Hindu majority, pork and beef consumption is virtually non-existent, while the dairy, poultry, and egg sectors have been expanding rapidly. The real question for India is whether they can continue to expand their corn area and sustain yield growth to hold down potential corn imports. Japan, one of the largest traditional corn feed use markets, is expected to have relatively flat feed demand over the projection period due to the stagnant general economy.

The European Union, Japan, and Indonesia are all expected to demonstrate relatively flat to falling trade paths for corn. The EU's tariff rate quotas (TRQ) severely limit import competition with their domestic producers. Even if the European Union were to lift their TRQs for corn as a WTO policy compromise, feed wheat prices should be competitive enough to keep corn imports low. Japan's declining livestock sector, perhaps worsened by the recent BSE case, will limit their corn imports. Further hampering the competitiveness of U.S. corn in Japan is their aversion to GMO products. Indonesia, grouped in the "Rapidly

Developing Asia" category, will have markedly reduced corn imports in 2002 due to strong yield growth from the rapid adoption of advanced hybrids. The United States, Argentina, Central Europe, and South Africa are forecast to expand their corn exports. The combination of yield growth and area expansion in Argentina is expected to drive Argentine exports to record levels. Argentina will increase its current market share in corn export markets, relative to the United States. U.S. corn exports (by all modes) are expected to increase from 49.1 mmt in 2000 to 59.2 mmt by 2010, or at 1.9% annually. Beyond 2010, exports are expected to increase modestly - at 0.5% annually through 2030.

Columbia River Corn Export Forecast

The Columbia River averaged 9.1% of U.S. corn exports in the period 1990 to 2000 but this decreased slightly to 8.9% in the period 1995 to 2000. Most corn exports move via the Gulf Coast (83% in the period 1995 to 2000) or Puget Sound (11.9% in the same period) and to a lesser extent the Great Lakes (4.1% in the same period).

Table 34 – Columbia River Corn Export Forecast (mmt)

		Forecast	
Year	**Actual**	**Low**	**High**
1991	4.1		
1992	3.6		
1993	3.0		
1994	1.7		
1995	7.2		
1996	4.4		
1997	4.3		
1998	1.6		
1999	3.1		
2000	2.7		
2010		3.3	5.8
2020		3.4	6.6
2030		3.6	7.2
Compound Annual Growth Rates			
1991-2000	-4.5%		
2000-2010		2.1%	8.0%
2010-2020		0.3%	1.2%
2020-2030		0.4%	0.9%
2000-2030		0.9%	3.3%

Source: BST Associates, DRI-WEFA

Columbia River corn exports are projected to range between 3.6 mmt and 7.2 mmt in 2030 or at average annual rates of growth of 0.9% (low) and 3.3% (high), respectively.

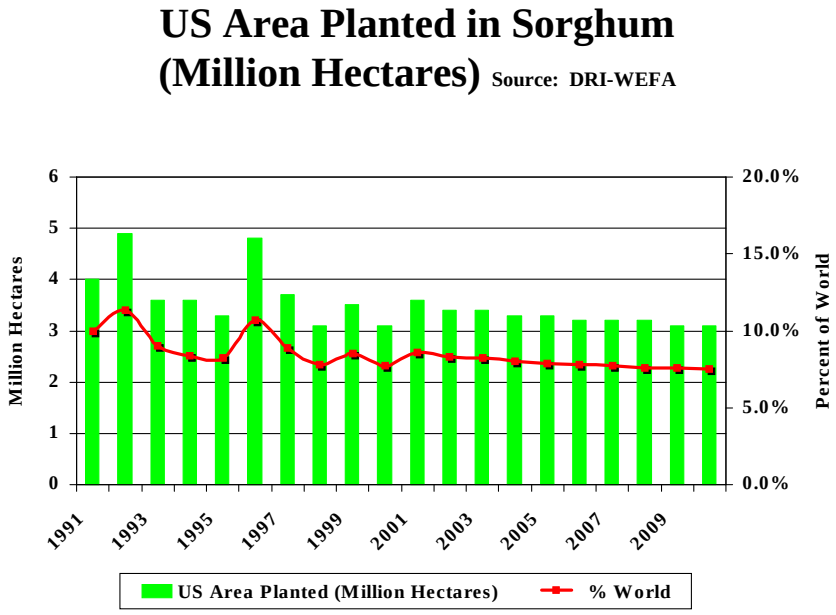
Sorghum Export Forecasts

The following section provides forecasts for sorghum exports via Lower Columbia River ports.

Acres in Sorghum Production

U.S. acreage in sorghum production is expected to decline from a peak of 4.9 million hectares in 1992 to approximately 3.1 million hectares by 2010. U.S. acreage in sorghum production is expected to decline from a peak of 11% in 1992 to 7.5% in 2010.

Figure 19 – U.S. Area Planted in Sorghum

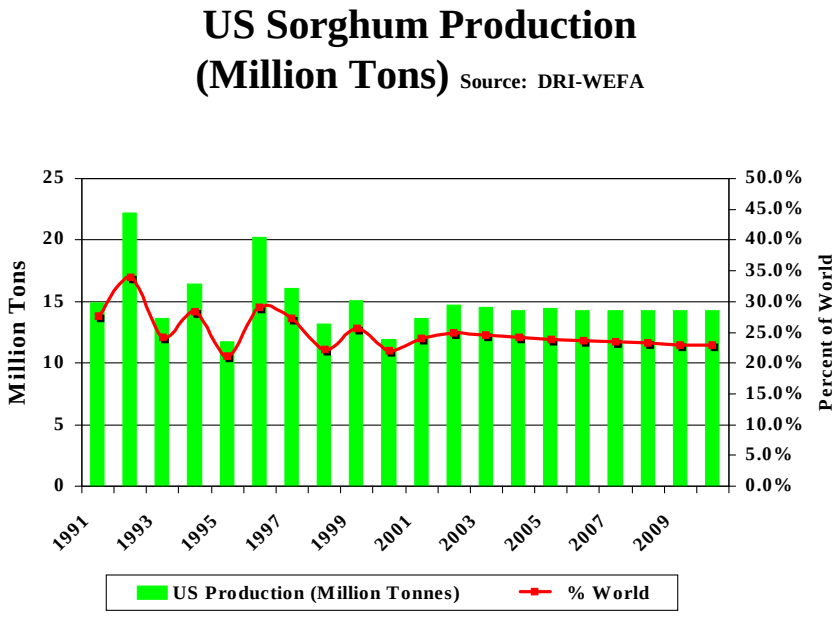


Sorghum Production

DRI-WEFA projects that world sorghum production will increase from 57 mmt in 2001 to 63 mmt in 2010, representing an increase of approximately 6 mmt. The additional production is projected to occur mainly in Africa (2.3 mmt), India (1.1 mmt), and Argentina (1.1 mmt).

U.S. production is only expected to increase by 0.7 mmt during the study period (on an annual basis). However, the U.S. is expected to continue to dominate world sorghum production throughout the study period, with production expected to increase from 13.6 mmt in 2001 to 14.3 mmt in 2010, or at 0.5% per year.

Figure 20 – U.S. Sorghum Production

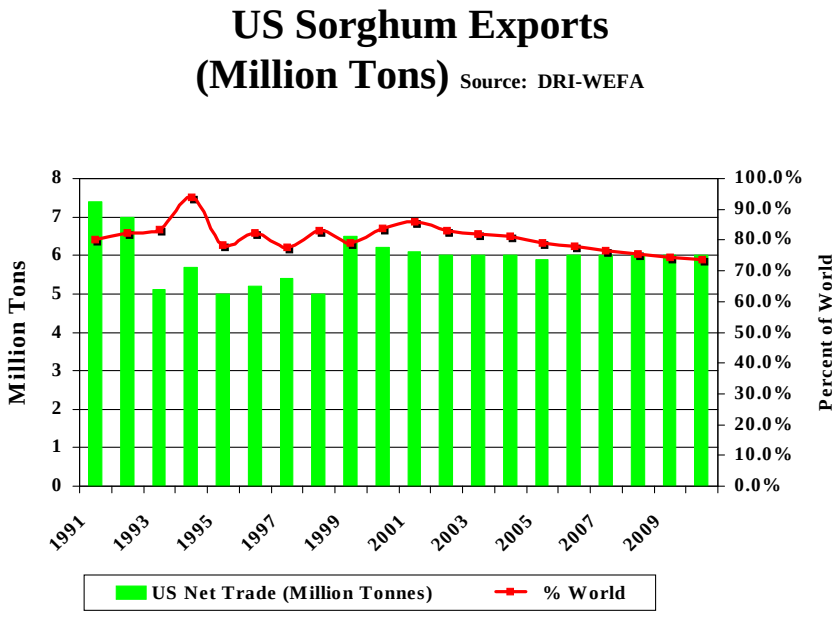


World Sorghum Trade

Mexico is the largest sorghum importer, with imports projected at between 4.5 and 5.0 mmt per year. Japanese sorghum imports are expected to be stable at 1.9 to 2.0 mmt, with a slight decline during the study period.

U.S. sorghum exports (by rail and water) are expected to continue to dominate world sorghum trade, but little growth is expected, with exports remaining at approximately 6 mmt throughout the study period. Argentina's exports are expected to increase significantly during the study period, albeit from a small base of 0.5 mmt in 2000 to 1.4 mmt in 2010.

Figure 21 – U.S. Net Sorghum Trade



Columbia River Sorghum Export Forecast

Columbia River ports are a minor player in the sorghum trades, accounting for 4.4% of the U.S. export market in the period from 1990 to 2000 but only 3.5% in the period 1995 to 2000. Most sorghum moves via the Gulf and to a much lesser extent Puget Sound ports.

Columbia River sorghum exports are projected to range between 0.08 mmt and 0.23 mmt in 2030.

Table 35 – Columbia River Sorghum Export Forecast (mmt)

		Forecast	
Year	Actual	Low	High
1991	0.15		
1992	0.38		
1993	0.13		
1994	0.07		
1995	0.24		
1996	0.14		
1997	0.19		
1998	0.05		
1999	0.06		
2000	0.09		
2010		0.08	0.21
2020		0.08	0.22
2030		0.08	0.23
Compound Annual Growth Rates			
1991-2000	-5.4%		
2000-2010		-1.0%	8.7%
2010-2020		-0.2%	0.7%
2020-2030		-0.1%	0.4%
2000-2030		-0.4%	3.2%

Source: BST Associates, DRI-WEFA

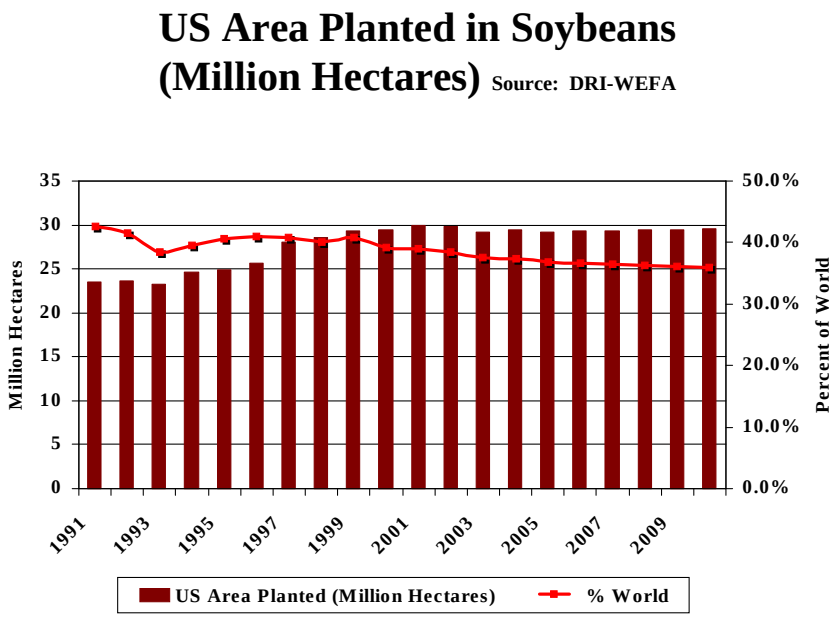
Soybean Export Forecasts

The following section provides forecasts for soybean exports via Lower Columbia River ports.

Acres in Soybean Production

In the United States, the relatively high soybean loan rate has stimulated growth in soybean acreage at the expense of wheat and corn. U.S. soybean area has expanded 18% over 1995-2000, with planted area expected to reach 30 million hectares in 2001. The U.S. soybean area will remain relatively flat in the long term, as competition from higher feed grains prices keep soybean area in check. However, due to relatively rapid expansion of acreage in Brazil and Argentina, U.S. acreage in soybean production is expected to decline from 40% of the world area planted in soybeans in the period 1995 through 2000 to about 35% in the forecast period (through 2010).

Figure 22 – U.S. Area Planted in Soybean



Soybean Production

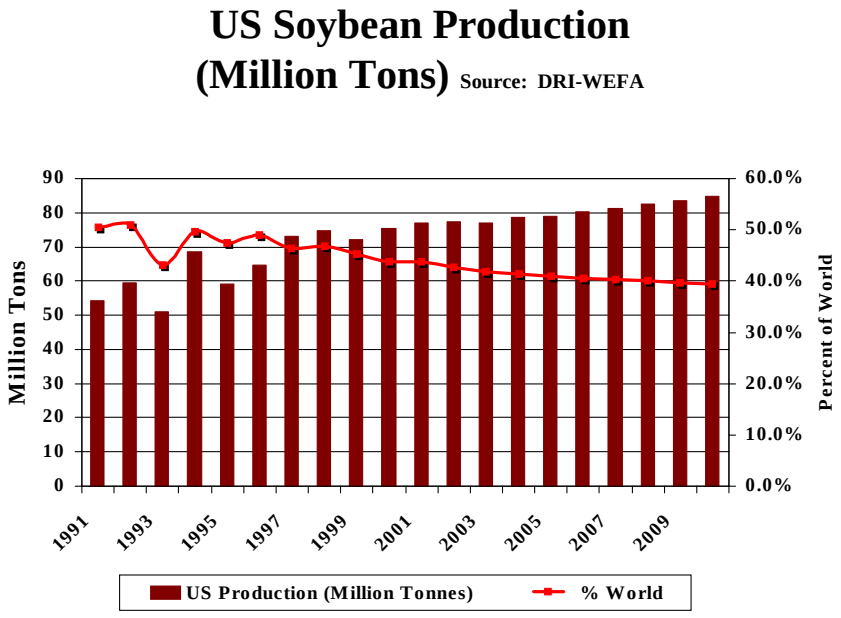
DRI-WEFA projects that world soybean production will increase from 176 mmt in 2001 to 215 mmt in 2010, representing an increase of approximately 39 mmt. The additional production is projected to occur mainly in:

- Brazil (18.6 mmt),
- U.S. (7.6 mmt),
- Argentina (6.9 mmt),

- China (2.8 mmt),
- India (1.5 mmt), and,
- Other producers will account for the remaining 1.3 mmt.

The U.S. is expected to continue to dominate world soybean production during most of the study period but the gap is expected to be closed by production in South America. U.S. soybean production is expected to increase from 77 mmt in 2002 to 85 mmt in 2010, or at 1.1% per year. Brazil and Argentina are jointly expected to increase production from 59 mmt in 2002 to 90 mmt, representing annual growth of 3.4%. As a result, U.S. production is expected to decline from 50% of world production to 40% of world production.

Figure 23 – U.S. Soybean Production



World Soybean Trade

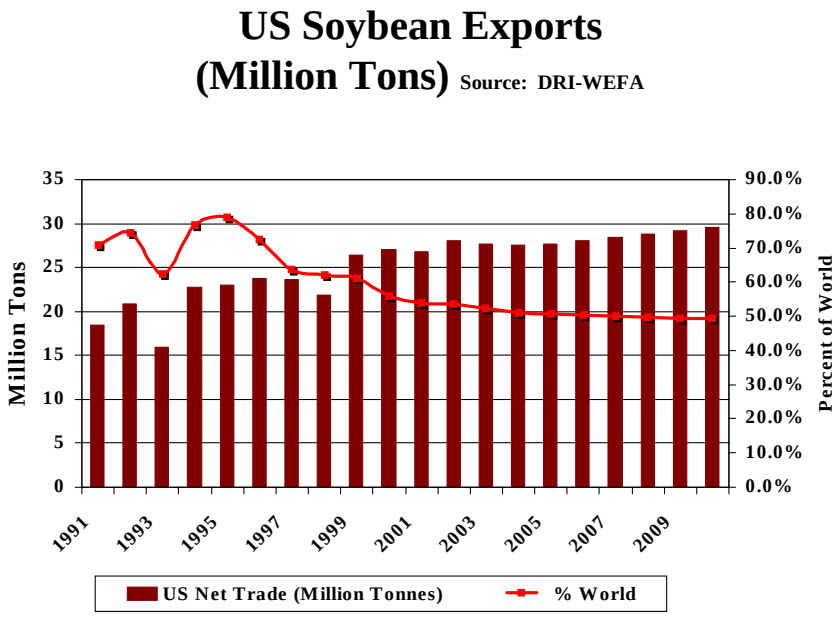
Soybean imports are forecast to grow significantly in the European Union, China, and several other Asian countries. China accounts for over half of the expansion in soybean demand over the forecast period, increasing soybean imports by 47% to 21 mmt by 2010. Brazil will supply over half of the exports for the growing demand, expanding exports by 58% to 22 mmt by the end of the forecast. As noted above, this trade increase will result from massive acreage expansion over the long term. The major risk to this forecast is Brazil's ability to invest in infrastructure to decrease transportation costs. The United States, Argentina, and Paraguay will supply the rest of the soybeans for the global market.

Brazil and Argentina supply virtually all of the growth in the world's soymeal and soybean oil export markets. China and India will provide the demand. Domestic pressures within

India are a risk to the forecast due to the proposed establishment of restrictive tariff rate quotas that could limit the long-term expansion of imports. Nevertheless, the lack of domestic production growth in the last decade could help to keep India's markets open.

Soybean meal tends to be the primary driver of soybean production. However, if shortages occur in palm oil as they did in 1997, oil prices could rise enough to drive soybean production. The Asian countries that are experiencing rapidly increasing corn feed demand are also seeing demand for protein meals increasing rapidly. Many of these countries also need soybean oil, and to capture the value added from crushing, whole bean imports tend to be the preferred import. Speculation exists concerning the current global economic slowdown and its implications for oil prices. Should the recovery be slower in arriving, the developing countries' demand for oils will be considerably weakened. Should the livestock sectors decline as a result of a global slowdown, the meal sector could also be hurt. Therefore, global oilseed markets are at risk of a dismal price scenario in the medium term, should the global economy fail to recover.

Figure 24 – U.S. Net Soybean Trade



The demand for oils in the Asian countries is so strong that even with the oil by-product from meal production, more oil is still imported. Palm oil has filled much of the demand for Asia because of its relatively low cost and the geographical proximity of the enormous producer nations, Malaysia and Indonesia. China, the European Union, and Rapidly Developing Asia are projected to be areas of export growth for whole beans and meal. India is projected to ease import restrictions and allow significantly more oils imports in the future.

U.S. soybean exports (by all modes) are expected to continue to be relatively robust, with exports remaining at approximately 6 mmt throughout the study period. Argentina's exports are expected to increase significantly during the study period, albeit from a small base of 0.5 mmt in 2000 to 1.4 mmt in 2010.

Columbia River Soybean Export Forecast

Columbia River ports are a minor player in the soybean trades, accounting for 4.4% of the U.S. export market in the period from 1990 to 2000 but only 3.5% in the period 1995 to 2000. Most soybean moves via the Gulf and to a lesser extent Puget Sound ports. However, soybean exports increased significantly in 2001, exceeding 1.0 mmt.

Columbia River soybean exports are projected to range between 0.8 mmt and 2.6 mmt in 2030, or at average annual rates of growth of 2.3% (low) and 6.6% (high) between 2000 and 2030.

Table 36 – Columbia River Soybean Export Forecast (mmt)

		Forecast	
Year	**Actual**	**Low**	**High**
1991	0.12		
1992	0.06		
1993	0.23		
1994	0.27		
1995	0.07		
1996	0.58		
1997	0.19		
1998	0.22		
1999	0.10		
2000	0.39		
2010		0.5	1.4
2020		0.6	1.9
2030		0.8	2.6
Compound Annual Growth Rates			
1991-2000	14.1%		
2000-2010		2.3%	13.3%
2010-2020		2.5%	3.5%
2020-2030		2.0%	3.2%
2000-2030		2.3%	6.6%

Source: BST Associates, DRI-WEFA

Beet Pulp Pellet Export Forecasts

The following section provides forecasts for beet pulp pellets via Lower Columbia River ports, based upon historical trends and estimated production capabilities. Beet pulp pellets are produced as a residual product of sugar beet processing in Nampa, Idaho. The plant capacity is expected to remain at existing levels during the study period.

Columbia River beet pulp pellet exports are projected to range between 0.24 mmt and 0.44 mmt in 2030, or at an average annual rates of growth from 2000 to 2030 of between –0.7% (low) and 1.3% (high).

Table 37 – Columbia River Beet Pulp Pellet Export Forecast (mmt)

		Forecast	
Year	**Actual**	**Low**	**High**
1991	0.27		
1992	0.30		
1993	0.38		
1994	0.37		
1995	0.38		
1996	0.36		
1997	0.36		
1998	0.21		
1999	0.25		
2000	0.30		
2010		0.22	0.40
2020		0.23	0.42
2030		0.24	0.44
Compound Annual Growth Rates			
1991-2000	1.0%		
2000-2010		-2.9%	2.9%
2010-2020		0.5%	0.5%
2020-2030		0.4%	0.4%
2000-2030		-0.7%	1.3%

Source: BST Associates, DRI-WEFA

Summary Supply-Constrained Forecasts

This section provides a summary of the forecast for grain and related products via Lower Columbia River ports. By 2030, the forecast projects grain & related products are expected to reach between 15.6 million tons (low) and 26.4 million tons (high), representing average annual growth rates of 0.3% (low) and 2.0% (high) relative to volumes in 2000.

Table 38 – Summary of Supply-Constrained Grain Forecasts for Lower Columbia River Ports

		Forecast	
Year	**Actual**	**Low**	**High**
1991	16.2		
1992	16.1		
1993	15.2		
1994	16.5		
1995	22.3		
1996	18.7		
1997	17.2		
1998	13.6		
1999	14.5		
2000	14.4		
2010		14.3	20.8
2020		15.0	23.6
2030		15.6	26.4
Compound Annual Growth Rates			
1991-2000	-1.5%		
2000-2010		0.0%	3.8%
2010-2020		0.4%	1.3%
2020-2030		0.4%	1.1%
2000-2030		0.3%	2.0%

Source: BST Associates, DRI-WEFA

Grain Forecasts Taking Into Account Channel Depth

The following section provides a summary forecast for grain and other related products (i.e., soybeans, beet pulp pellets) under existing conditions (without channel deepening) and proposed conditions (with deepening to 43 feet). First, it is instructive to describe the competition that exists between Columbia River grain elevators and those located in Puget Sound and the Gulf Coast, since improvement of the channel could improve vessel costs and increase market share.

National Competition

Pacific Northwest grain elevators (in the Lower Columbia River and Puget Sound) are in competition with elevators in the Gulf Coast and to a lesser extent in the Great Lakes and East Coast. The level of competition depends upon the company involved, origin of the product, final destination overseas and the relative cost of transportation.

As shown in Table 39, PNW elevators have captured the following shares of U.S. exports by product type during the period 1990 to 2000:

- Wheat - average 39% of U.S. exports, ranging from a low of 33% to a high of 47%[5],
- Barley - average 41% of U.S. exports, ranging from a low of 8% to a high of 76%,
- Corn - average 20% of U.S. exports, ranging from a low of 10% to a high of 30%,
- Sorghum - average 7% of U.S. exports, ranging from a low of 4% to a high of 16%,
- Soybeans - average 7% of U.S. exports, ranging from a low of 4% to a high of 10%,
- Total - average 23% of U.S. exports, ranging from a low of 19% to a high of 29%,

Table 39 – PNW Market Share of U.S. Grain & Related Exports

Year	Wheat	Barley	Corn	Sorghum	Soybeans	Total
1990	37.1%	23.6%	24.8%	16.5%	6.8%	25.2%
1991	35.3%	34.9%	20.2%	7.0%	6.2%	22.5%
1992	34.2%	18.8%	16.9%	8.4%	6.8%	20.6%
1993	33.0%	23.7%	15.9%	7.2%	5.8%	20.0%
1994	47.1%	7.5%	11.7%	4.6%	4.9%	22.8%
1995	40.9%	72.8%	30.1%	8.7%	9.5%	29.0%
1996	40.6%	56.3%	22.4%	6.4%	7.7%	24.2%
1997	44.5%	41.3%	28.4%	8.7%	7.8%	26.8%
1998	42.1%	76.4%	10.7%	4.2%	3.9%	19.0%
1999	36.0%	58.3%	17.9%	4.3%	4.8%	20.2%
2000	37.6%	39.8%	15.2%	4.7%	8.0%	19.4%
Average	39.0%	41.2%	19.5%	7.3%	6.6%	22.7%

Source: BST Associates, using data from MARAD

[5] Over the long-term, the Columbia River has increased market share of wheat exports from 28% in the period 1981 through 1985, 36% in 1986-90, 42% in 1991-95 and 43% in 1996-00.

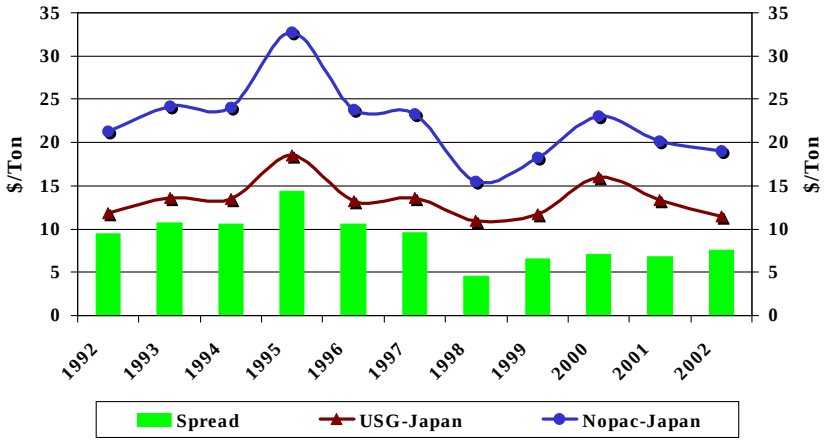
PNW elevators mainly handle exports bound for Asia, however, market share depends upon the strength of overseas markets and relative transportation costs. PNW grain elevator market shares were increasing for most products until 1997. However, export shares declined between 1997 and 2000 due mainly to the strength of the U.S. dollar, coupled with decreased demand in Asia after the Asian Financial crisis.

Most of the wheat and barley exported via PNW elevators moves via the Lower Columbia River elevators and is grown in Washington, Oregon, Idaho and the northern plains. Approximately 58% of the wheat/barley arriving at Lower Columbia River elevators moves by rail and 41% by barge (with approximately 25% originating on the Snake River and 16% on the Columbia River)[6]. Barge transportation offers low cost, high capacity access for shippers.

Most of the other products (corn, sorghum and soybeans) originate in the Midwest and are shipped by rail to Lower Columbia River and Puget Sound elevators. Rail movements have experienced significant improvements in cost effectiveness due to utilization of 110-car unit trains. In addition, the Class I railroads have substantially improved their grain car fleet, adding more than 50,000 cars during the past decade. Newer cars also have an improved load capacity.

Figure 25 – Panamax Vessel Rate Differentials[7]

Comparison of Ocean Rates for Grain ($/Ton – 52,000 DWT) **Source: BST Associates using data from Clarkson Research Studies**



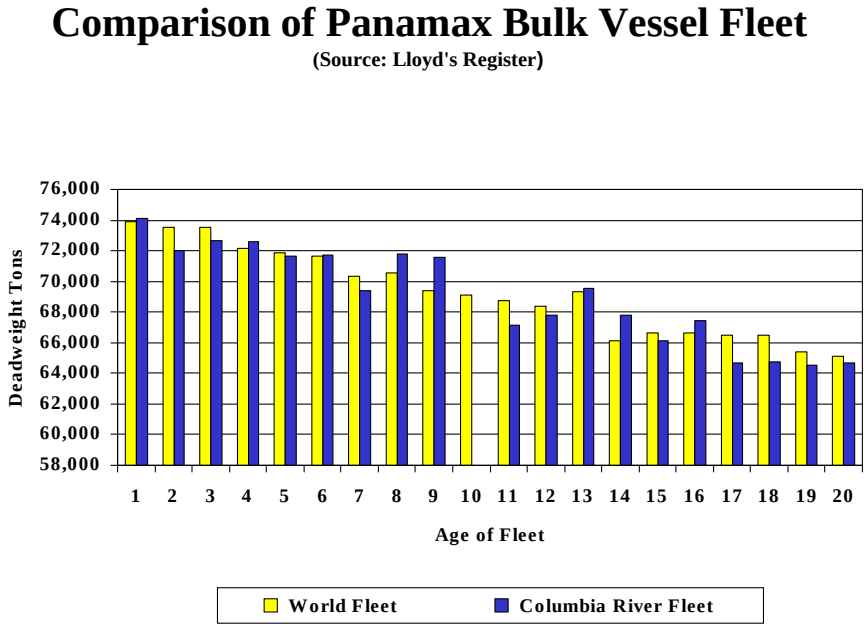
[6] Source: EWITS Report #13, using data from R. Guimary and Associates. A small portion also arrives by truck from Willamette Valley farms. However, these movements are inefficient at the elevator and are being phased out.

[7] Data for 2002 is the average from January through April.

The differential between the ocean going rates to ship from the Gulf to Asia versus the PNW to Asia are particularly important. As shown in Figure 25, the differences between the rates averaged $10 or more per ton from 1993 through 1997 for Panamax vessels with a deadweight tonnage (DWT) of 52,000 tons. However, after 1997 the rate differential has more typically ranged from $5 to $10 per ton. Rates for Panamax vessels fell after the Asian Financial crisis of 1997 in response to decreased demand.

The Panamax bulk fleet is primarily limited with respect to beam (106 feet) and draft (39 to 40 feet) restrictions imposed by the Panama Canal. However, an increasing share of the fleet is being designed to carry heavier loads. These vessels can exceed the draft (and load) limits of the Panama Canal if they are deployed in routes that do not transit the Canal. For example, some of the newer vessels can be loaded up to a design draft of 46 feet if deployed in the Pacific Ocean (from U.S. West Coast to Asia). As shown in Figure 26, the characteristics of the world fleet are mirrored in the Columbia River, with the average DWT very consistent between the entire fleet and those vessels calling the Columbia River. Older Panamax bulk vessels (15 to 20 years old) typically have an average DWT of 64,000 to 66,000 DWT. Newer Panamax bulk vessels (less than 5 years old) have an average DWT of 72,000 to 74,000 DWT.

Figure 26 – Relative Distribution of Panamax Bulk Fleet



Panamax vessels are typically loaded with stores, fuel and other supplies of approximately 1,500 to 2,500 tons per voyage. Older vessels would be able to carry approximately 63,000 metric tons (65,000 DWT – 2,000 tons) while newer vessels could carry approximately

71,00 metric tons (73,000 DWT – 2,000 tons)[8]. Trade routes can shift relatively easily if there are cost efficiencies in making the change. Having access to a deeper channel could attract additional cargo in the Lower Columbia River, increasing market shares.

Regional Competition - Relative Market Shares

Lower Columbia River elevators also compete with Puget Sound elevators (i.e., located in Tacoma and Seattle) for a share of the corn, sorghum and soybeans/meal that transit PNW ports. As shown in Table 40, the Columbia River has experienced a sustained decline in market share in corn and sorghum:

- Corn – down from 57% to 42% during the time period, representing a loss of nearly 15% in market share, and,
- Sorghum – down from 65% to 42% during the time period, representing a loss of nearly 23% in market share,

Table 40 – Lower Columbia River Market Share of PNW Grain & Related Exports (%)

Commodity	Wheat	Barley	Corn	Sorghum	Soybeans	Total
1990	99.5%	98.7%	56.6%	64.9%	11.2%	74.7%
1991	99.2%	88.7%	50.6%	61.4%	8.2%	75.3%
1992	98.6%	75.3%	54.6%	78.5%	19.2%	78.4%
1993	97.1%	98.0%	51.6%	44.7%	28.6%	78.6%
1994	95.8%	98.9%	45.7%	48.7%	8.4%	82.0%
1995	99.9%	99.9%	47.2%	77.5%	28.6%	69.9%
1996	99.4%	99.2%	43.9%	57.3%	14.0%	70.6%
1997	98.9%	100.0%	43.1%	51.5%	12.6%	68.5%
1998	99.4%	99.8%	39.7%	46.6%	15.9%	80.6%
1999	98.9%	99.8%	37.1%	49.1%	41.2%	70.4%
2000	99.4%	87.4%	42.2%	41.7%	21.6%	71.6%
Average	98.7%	95.1%	46.6%	56.5%	19.0%	74.6%

Source: BST Associates, using data from MARAD

Relative Vessel & Load Sizes

The loss of market share is partially explained by restrictions on the Columbia River navigation channel. The existing channel is limited to 40 feet, which limits grain shipments to a 60,000-ton load. The Puget Sound elevators have water depth of 50+ feet, which allows vessels to be loaded to increased depths and provides an economic incentive for shippers and this advantage is being utilized. As shown in Table 41, Puget Sound grain terminals loaded nearly twice the tonnage compared to the Columbia River grain terminals in 2000/2001. In addition, Puget Sound terminals handled the majority of the Panamax tonnage and all of the larger loads. The same vessels call in both port regions but the average load was greater in Puget Sound than in the Lower Columbia River. The average Panamax DWT for both Columbia River and Puget Sound vessels handling shipment sizes of 50,000 to 60,000 tons was 69,000 DWT, with an average shipment size of 57,000 metric

[8] Source: Columbia River Pilots.

tons. The average DWT for vessels with 60,000 tons or greater shipment size in the Puget Sound area was 71,500 metric tons, with an average shipment size of 62,000 metric tons.

Nearly 30% of the Puget Sound tonnage moves in shipments exceeding 60,000 tons, which are beyond the limit imposed by the existing Columbia River channel. The primary destinations for shipments exceeding 60,000 tons from Puget Sound were Taiwan and the PRC, which are both expected to be good future markets for U.S. grain and related products.

Table 41 – Relative Size of PNW Grain Export Loads (Metric Tons)

Shipment Size (Metric Tons)	Columbia River	Puget Sound	Total
Under 50,000	2,861,002	2,844,142	5,705,144
50,000 up to 60,000	2,961,718	5,310,297	8,272,014
Over 60,000		3,305,366	3,305,366
Total	5,822,719	11,459,804	17,282,523
Percent of Load by Shipment Size			
Under 50,000	49%	25%	33%
50,000 up to 60,000	51%	46%	48%
Over 60,000	0%	29%	19%

Note: only includes soybeans, sorghum, and corn for the period 2000 and 2001
Source: Port of Portland, using data from New York Journal of Commerce

As indicated above, the Columbia River channel depth is 40 feet at the present time and outbound vessels with a draft greater than 35 feet may be impacted by the channel depth. With improved channel depth, the Columbia River could potentially increase its market share of PNW grain and related product exports. The following section provides forecasts for existing (without deepening) and proposed (with deepening) conditions.

Without Channel Improvements

Table 42 provides a summary of forecasts for grain and related products via Columbia River export elevators in the event that the channel is not deepened. The forecast calls for the following grain throughput without channel deepening:

- Wheat – projected to reach 10.5 million tons (low) to 13.9 million tons (high) by 2030, with growth at average annual rates of 0.1% to 1.0% between 2000 and 2030,
- Barley – projected to reach 0.4 million tons (low) to 0.6 million tons (high) by 2030, with growth at average annual rates of –1.8% to –0.3% between 2000 and 2030,
- Corn – projected to reach 3.6 million tons (low) to 5.5 million tons (high) by 2030, with growth at average annual rates of 0.9% to 2.4% between 2000 and 2030,
- Sorghum – projected to reach 0.16 million tons (low) to 0.19 million tons (high) by 2030, with growth at average annual rates of 0.4% to 1.1% between 2000 and 2030,
- Soybeans – projected to reach 1.7 million tons (low) to 2.1 million tons (high) by 2030, with growth at average annual rates of 5.0% to 5.8% between 2000 and 2030,

- Beet Pulp Pellets – projected to reach 0.2 million tons (low) to 0.4 million tons (high) by 2030, with growth at average annual rates of –0.7% to +0.5% between 2000 and 2030, and,
- All Products - projected to reach 16.5 million tons (low) to 22.5 million tons (high) by 2030, with growth at average annual rates of 0.5% to 1.5% between 2000 and 2030.

With Channel Improvements

Table 43 provides a summary of forecasts for grain and related products via Columbia River export elevators in the event that the channel is deepened. The forecast calls for the following grain throughput with channel deepening to 43 feet:

- Wheat – projected to reach 11.1 million tons (low) to 15.0 million tons (high) by 2030, with growth at average annual rates of 0.3% to 1.3% between 2000 and 2030,
- Barley – projected to reach 0.65 million tons (low) to 0.8 million tons (high) by 2030, with growth at average annual rates of –0.1% to 0.6% between 2000 and 2030,
- Corn – projected to reach 5.0 million tons (low) to 7.2 million tons (high) by 2030, with growth at average annual rates of 2.1% to 3.3% between 2000 and 2030,
- Sorghum – projected to reach 0.16 million tons (low) to 0.19 million tons (high) by 2030, with growth at average annual rates of 1.8% to 2.6% between 2000 and 2030,
- Soybeans – projected to reach 2.2 million tons (low) to 2.7 million tons (high) by 2030, with growth at average annual rates of 5.9% to 6.7% between 2000 and 2030,
- Beet Pulp Pellets – projected to reach 0.3 million tons (low) to 0.4 million tons (high) by 2030, with growth at average annual rates of 0.4% to 1.1% between 2000 and 2030, and,
- All Products - projected to reach 19.4 million tons (low) to 26.3 million tons (high) by 2030, with growth at average annual rates of 1.0% to 2.0% between 2000 and 2030.

Table 42 – Lower Columbia River Grain Forecasts under Existing Channel Conditions

				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
Wheat									
1991	11.0			99%			35%		
1995	13.5			100%			41%		
2000	10.2			100%			37%		
Ave 91-00				99%			38%		
2010		9.8	11.6		100%	100%		38%	42%
2020		10.2	12.8		100%	100%		39%	41%
2030		10.5	13.9		100%	100%		39%	41%
Compound Annual Growth Rates				*Changes in Market Share relative to average 1991-2000*					
1991-2000	-0.8%								
2000-2010		-0.4%	1.3%		1.3%	1.3%		-0.3%	3.2%
2010-2020		0.4%	1.0%		0.0%	0.0%		0.5%	-0.1%
2020-2030		0.3%	0.8%		0.0%	0.0%		0.5%	0.0%
2000-2030		0.1%	1.0%		1.3%	1.3%		0.7%	3.1%
				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
Barley									
1991	0.6			89%			32%		
1995	1.0			100%			64%		
2000	0.7			93%			134%		
Ave 91-00				96%			44%		
2010		0.4	0.6		100%	100%		43%	55%
2020		0.4	0.6		100%	100%		43%	54%
2030		0.4	0.6		100%	100%		43%	54%
Compound Annual Growth Rates				*Changes in Market Share relative to average 1991-2000*					
1991-2000	1.9%								
2000-2010		-4.8%	-1.5%		4.3%	4.3%		-1.4%	11.0%
2010-2020		-0.6%	0.2%		0.0%	0.0%		0.0%	-0.7%
2020-2030		-0.1%	0.3%		0.0%	0.0%		0.0%	-0.3%
2000-2030		-1.8%	-0.3%		4.3%	4.3%		-1.4%	10.0%

Table 42 – Lower Columbia River Grain Forecasts under Existing Channel Conditions (Continued)

				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**	**Low**	**High**	**Actual**
Corn									
1991	4.1			51%			10%		
1995	7.2			47%			14%		
2000	2.7			42%			14%		
Ave 91-00				46%			9%		
2010		3.3	4.5		43%	36%		7%	8%
2020		3.4	5.0		43%	35%		7%	8%
2030		3.6	5.5		43%	35%		7%	8%
	Compound Annual Growth Rates			*Changes in Market Share relative to average 1991-2000*					
1991-2000	-4.5%								
2000-2010		2.1%	5.3%		-2.7%	-9.9%		-2.1%	-0.3%
2010-2020		0.3%	1.1%		0.0%	-0.5%		0.0%	-0.1%
2020-2030		0.4%	0.8%		0.0%	-0.2%		0.0%	-0.1%
2000-2030		0.9%	2.4%		-2.7%	-10.7%		-2.1%	-0.5%
				Estimated Market Shares					
				LCR % of NPAC			LCR % of US		
Year	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**
Sorghum									
1991	0.1			56%			6%		
1995	0.2			76%			8%		
2000	0.1			44%			5%		
Average 91-00				54%			4%		
2010		0.1	0.1		59%	36%		3%	3%
2020		0.1	0.1		59%	35%		3%	3%
2030		0.1	0.1		58%	35%		3%	3%
	Compound Annual Growth Rates			*Changes in Market Share relative to average 1991-2000*					
2000-2010		1.7%	2.5%		5.1%	-18.5%		-0.6%	-0.6%
2010-2020		-0.3%	0.6%		-0.7%	-0.4%		0.0%	0.0%
2020-2030		-0.1%	0.3%		-0.3%	-0.2%		0.0%	0.0%
2000-2030		0.4%	1.1%		4.0%	-19.1%		-0.7%	-0.7%

Table 42 – Lower Columbia River Grain Forecasts under Existing Channel Conditions (Continued)

				Estimated Market Shares					
				LCR % of NPAC			LCR % of US		
Year	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**
Soybeans									
1991	0.1			11%			6%		
1995	0.1			4%			7%		
2000	0.4			20%			8%		
Ave 91-00				17%			1%		
2010		1.0	1.1		33%	20%		4%	4%
2020		1.3	1.6		33%	19%		4%	4%
2030		1.7	2.1		34%	19%		4%	4%
	Compound Annual Growth Rates			*Changes in Market Share relative to average 1991-2000*					
1991-2000	14.1%								
2000-2010		10.4%	11.3%		16.2%	2.9%		2.9%	3.0%
2010-2020		2.4%	3.3%		-0.3%	-0.4%		0.0%	-0.1%
2020-2030		2.4%	2.8%		1.0%	-0.6%		0.1%	-0.1%
2000-2030		5.0%	5.8%		17.0%	1.9%		3.0%	2.7%
				Estimated Market Shares					
				LCR % of NPAC			LCR % of US		
Year	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**
Beet Pulp Pellets									
1991	0.3			100%			46%		
1995	0.4			100%			46%		
2000	0.3			100%			49%		
Ave 91-00				100%			50%		
2010		0.2	0.3		100%	100%		49%	46%
2020		0.2	0.3		100%	100%		49%	47%
2030		0.2	0.4		100%	100%		49%	47%
	Compound Annual Growth Rates			*Changes in Market Share relative to average 1991-2000*					
1991-2000	1.0%								
2000-2010		-2.9%	0.4%		0.0%	0.0%		-0.5%	-4.0%
2010-2020		0.5%	0.7%		0.0%	0.0%		0.0%	1.0%
2020-2030		0.4%	0.5%		0.0%	0.0%		0.0%	0.5%
2000-2030		-0.7%	0.5%		0.0%	0.0%		-0.5%	-2.5%

Table 42 – Lower Columbia River Grain Forecasts under Existing Channel Conditions (Continued)

				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**
Total									
1991	16.2			76%			17%		
1995	22.3			70%			20%		
2000	14.4			73%			14%		
Ave 91-00				75%			17%		
2010		14.9	18.3		69%	57%		14%	16%
2020		15.7	20.5		68%	54%		14%	16%
2030		16.5	22.5		67%	52%		13%	15%
Compound Annual Growth Rates				*Changes in Market Share relative to average 1991-2000*					
1991-2000	-1.3%								
2000-2010		0.4%	2.4%		-5.8%	-18.2%		-2.8%	-0.7%
2010-2020		0.5%	1.1%		-1.2%	-2.6%		-0.5%	-0.6%
2020-2030		0.5%	1.0%		-1.0%	-2.4%		-0.4%	-0.6%
2000-2030		0.5%	1.5%		-8.1%	-23.1%		-3.8%	-1.9%

Source: BST Associates, DRI-WEFA

Table 43 – Lower Columbia River Grain Forecasts under Improved Channel Conditions

				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
Wheat									
1991	11.0			99%			35%		
1995	13.5			100%			41%		
2000	10.2			100%			37%		
Ave 91-00				99%			38%		
2010		10.5	12.2		100%	100%		41%	44%
2020		10.7	13.6		100%	100%		41%	44%
2030		11.1	15.0		100%	100%		41%	45%
Compound Annual Growth Rates				*Changes in Market Share relative to Ave 1991-2000*					
1991-2000	-0.8%								
2000-2010		0.3%	1.8%		1.3%	1.3%		2.5%	5.3%
2010-2020		0.2%	1.1%		0.0%	0.0%		-0.3%	0.5%
2020-2030		0.4%	0.9%		0.0%	0.0%		0.7%	0.5%
2000-2030		0.3%	1.3%		1.3%	1.3%		2.9%	6.3%
				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
Barley									
1991	0.6			89%			32%		
1995	1.0			100%			64%		
2000	0.7			93%			134%		
Ave 91-00				96%			44%		
2010		0.7	0.7		100%	100%		71%	71%
2020		0.7	0.8		100%	100%		71%	71%
2030		0.7	0.8		100%	100%		72%	72%
Compound Annual Growth Rates				*Changes in Market Share relative to Ave 1991-2000*					
1991-2000	1.9%								
2000-2010		0.1%	1.0%		4.3%	4.3%		26.6%	26.6%
2010-2020		-0.5%	0.4%		0.0%	0.0%		0.9%	0.9%
2020-2030		0.0%	0.5%		0.0%	0.0%		0.5%	0.5%
2000-2030		-0.1%	0.6%		4.3%	4.3%		27.9%	27.9%

Table 43 – Lower Columbia River Grain Forecasts under Improved Channel Conditions (Continued)

				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**
Corn									
1991	4.1			51%			10%		
1995	7.2			47%			14%		
2000	2.7			42%			14%		
Ave 91-00				46%			9%		
2010		4.6	5.8		60%	46%		9%	11%
2020		4.8	6.6		60%	46%		9%	11%
2030		5.0	7.2		60%	46%		9%	11%
Compound Annual Growth Rates				*Changes in Market Share relative to Ave 1991-2000*					
1991-2000	-4.5%								
2000-2010		5.5%	8.0%		14.2%	0.3%		0.6%	2.1%
2010-2020		0.3%	1.2%		0.0%	0.0%		0.0%	0.0%
2020-2030		0.4%	0.9%		0.1%	0.0%		0.0%	0.0%
2000-2030		2.1%	3.3%		14.2%	0.3%		0.6%	2.1%
				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**
Sorghum									
1991	0.1			56%			6%		
1995	0.2			76%			8%		
2000	0.1			44%			5%		
Ave 91-00				54%			4%		
2010		0.2	0.2		87%	53%		5%	5%
2020		0.2	0.2		88%	53%		5%	5%
2030		0.16	0.19		89%	54%		5%	5%
Compound Annual Growth Rates				*Changes in Market Share relative to Ave 1991-2000*					
1991-2000	-5.4%								
2000-2010		5.6%	6.5%		32.5%	-1.9%		0.8%	0.8%
2010-2020		-0.1%	0.8%		1.1%	0.7%		0.1%	0.1%
2020-2030		0.0%	0.5%		0.6%	0.4%		0.0%	0.0%
2000-2030		1.8%	2.6%		34.3%	-0.8%		0.9%	0.9%

Table 43 – Lower Columbia River Grain Forecasts under Improved Channel Conditions (Continued)

				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
Soybeans									
1991	0.1			11%			6%		
1995	0.1			4%			7%		
2000	0.4			20%			8%		
Ave 91-00				17%			1%		
2010		1.3	1.4		40%	24%		5%	5%
2020		1.7	2.0		41%	24%		5%	5%
2030		2.2	2.7		44%	25%		5%	5%
Compound Annual Growth Rates				*Changes in Market Share relative to Ave 1991-2000*					
1991-2000	14.1%								
2000-2010		12.5%	13.4%		23.2%	7.1%		3.8%	3.8%
2010-2020		2.8%	3.7%		1.1%	0.4%		0.1%	0.1%
2020-2030		2.7%	3.2%		2.9%	0.1%		0.4%	0.0%
2000-2030		5.9%	6.7%		27.1%	7.6%		4.3%	3.9%
				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	Actual	Low	High	Actual	Low	High	Actual	Low	High
Beet Pulp Pellets									
1991	0.3			100%			46%		
1995	0.4			100%			46%		
2000	0.3			100%			49%		
Ave 91-00				100%			50%		
2010		0.3	0.4		100%	100%		76%	46%
2020		0.3	0.4		100%	100%		71%	47%
2030		0.3	0.4		100%	100%		69%	48%
Compound Annual Growth Rates				*Changes in Market Share relative to Ave 1991-2000*					
1991-2000	1.0%								
2000-2010		1.4%	2.2%		0.0%	0.0%		26.4%	-3.8%
2010-2020		-0.2%	0.7%		0.0%	0.0%		-5.1%	1.0%
2020-2030		0.0%	0.5%		0.0%	0.0%		-2.5%	0.5%
2000-2030		0.4%	1.1%		0.0%	0.0%		18.8%	-2.3%

Table 43 – Lower Columbia River Grain Forecasts under Improved Channel Conditions (Continued)

				Estimated Market Shares					
		Forecast		LCR % of NPAC			LCR % of US		
Year	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**	**Actual**	**Low**	**High**
Total									
1991	16.2			76%			17%		
1995	22.3			70%			20%		
2000	14.4			73%			14%		
Ave 91-00				75%			17%		
2010		17.6	20.7		82%	64%		17%	18%
2020		18.3	23.6		79%	62%		16%	17%
2030		19.4	26.3		79%	61%		16%	16%
Compound Annual Growth Rates				*Changes in Market Share relative to Ave 1991-2000*					
1991-2000	-1.3%								
2000-2010		2.1%	3.7%		6.6%	-10.8%		-0.3%	1.0%
2010-2020		0.4%	1.3%		-2.3%	-1.8%		-0.8%	-0.8%
2020-2030		0.6%	1.1%		-0.5%	-1.9%		-0.4%	-0.8%
2000-2030		1.0%	2.0%		3.8%	-14.5%		-1.4%	-0.5%

Source: BST Associates, DRI-WEFA

DRY BULKS

The following section provides forecasts for non-grain dry bulks.

HISTORICAL TRENDS

Exports

Dry bulk exports via Lower Columbia River ports increased dramatically between 1990 to 2000, growing from 3.1 million tons in 1990 to nearly 5.0 million tons in 2000. This amounted to annualized growth of 4.8%. Much of the growth was due to the startup of Canadian potash exports in 1997, and relatively rapid growth in soda ash and petroleum coke exports.

Declining volumes were registered for bentonite clay, wood chips and ores and concentrates. The wood export facility at Linnton has been closed and ores/concentrates did not pass through the ports in 2001.

Table 44 – Dry Bulk Exports via Columbia River Ports (1,000s of Metric Tons)

Exports	Soda ash	Potash	Bentonite Clay	Wood Chips	Ores & Concentrates	Pet Coke	Subtotal
1990	1,326	89	265	914	190	408	3,104
1991	1,568	117	225	970	111	285	3,158
1992	1,768	248	228	758	210	492	3,456
1993	1,956	172	230	747	70	496	3,499
1994	1,972	304	304	571	39	499	3,386
1995	2,141	534	234	192	69	620	3,256
1996	2,346	181	159	207	227	572	3,511
1997	2,736	681	216	5	158	584	4,363
1998	2,138	1,554	196	1	40	502	4,436
1999	2,142	1,608	198	0	59	545	4,667
2000	2,207	1,812	205	25	47	537	4,969
CAGR 90-00	5.2%	35.2%	-2.5%	-30.4%	-13.1%	2.8%	4.8%

Source: BST Associates, using data from MARAD and the Port of Portland

Imports

Dry bulk imports declined modestly during the past decade, declining from 2.7 million tons to 2.5 million tons. Increases in cement and fertilizers nearly compensated for losses in salt, limestone and alumina imports.

Table 45 – Dry Bulk Imports via Columbia River Ports (1,000s of Metric Tons)

Imports	Salt	Limestone	Cement	Alumina	Fertilizer	Subtotal
1990	386	465	254	1,587	47	2,739
1991	394	309	231	1,620	50	2,604
1992	292	409	193	1,431	32	2,357
1993	332	463	196	1,263	53	2,307
1994	268	517	242	1,017	23	2,066
1995	275	490	295	1,098	25	2,182
1996	407	514	368	1,100	25	2,413
1997	280	483	438	901	34	2,136
1998	352	510	433	1,261	137	2,692
1999	254	415	466	1,192	121	2,447
2000	285	436	460	1,223	136	2,540
CAGR 90-00	-3.0%	-0.6%	6.1%	-2.6%	11.2%	-0.8%

Source: BST Associates, using data from MARAD and the Port of Portland

Coastwise Receipts

Columbia River ports had previously received non-metallic minerals but these receipts ceased in 1998. The only other major domestic receipt is wood chips from Washington State bound for area mills.

Table 46 – Coastwise Receipts of Dry Bulks via Columbia River Ports (1,000s of Metric Tons)

Year	Wood Chips	Non-Metal. Min. NEC
1990	413.0	
1991	356.0	
1992	248.0	140.0
1993	246.0	110.0
1994	313.0	132.0
1995	276.0	214.0
1996	372.0	262.0
1997	421.0	528.0
1998	453.0	270.0
1999	464.0	
2000	419.1	
CAGR		
1990-2000	0.1%	NM

Source: BST Associates, using data from USACE

FORECASTS

Exports

Dry bulk exports via Lower Columbia River ports are expected to remain slightly below existing levels (4.4 million tons) under the low growth scenario. Under the high growth scenario, dry bulk exports are expected to reach 8.0 million tons, with average annual growth of 1.7% between 2000 and 2030.

Table 47 – Lower Columbia River Dry Bulk Export Forecast (1,000 Metric Tons)

	Soda ash		Potash		Bentonite Clay		Ores/Concentrates		Pet Coke		Subtotal	
Year	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
1990 Actual	1,326		89		265		190		408		2,278	
2000 Actual	2,207		1,812		205		47		537		4,808	
Forecast												
2010	2,197	2,619	1,500	1,974	209	255	37	59	509	571	4,451	5,478
2020	2,244	3,265	1,500	2,383	216	327	29	66	485	626	4,474	6,666
2030	2,203	4,019	1,500	2,933	215	361	25	66	462	643	4,405	8,021
Compound Annual Growth Rates												
1990-2000	5.2%		35.2%		-2.5%		-13.1%		2.8%		7.8%	
2000-2010	0.0%	1.7%	-1.9%	0.9%	0.2%	2.2%	-2.3%	2.4%	-0.5%	0.6%	-0.8%	1.3%
2010-2020	0.2%	2.2%	0.0%	1.9%	0.4%	2.5%	-2.3%	1.1%	-0.5%	0.9%	0.1%	2.0%
2020-2030	-0.2%	2.1%	0.0%	2.1%	-0.1%	1.0%	-1.4%	0.1%	-0.5%	0.3%	-0.2%	1.9%
2000-2030	0.0%	2.0%	-0.6%	1.6%	0.2%	1.9%	-2.0%	1.2%	-0.5%	0.6%	-0.3%	1.7%

Source: BST Associates, DRI-WEFA

Imports

Dry bulk imports via Lower Columbia River ports are to decline from 2.5 million tons in 2000 to 1.8 million tons in 2030, representing a loss of 0.9% per year under the low-growth scenario. Most of the loss is associated with declining volumes of alumina and salt. Under the high growth scenario, dry bulk imports are expected to reach 3.4 million tons, with average annual growth of 1.0% between 2000 and 2030.

Coastwise Receipts

Coastwise receipts of wood chips, the only major dry bulk on domestic routes, are expected to decline under the low growth scenario from 419,000 in 2000 to 336,000 tons in 2030. Under the high growth scenario, wood chip receipts are projected to increase at an average annual rate of 1.2%, reaching 608,000 tons by 2030.

Table 48 – Dry Bulk Import Forecasts (1,000s of Metric Tons)

	Salt		Limestone Gypsum		Cement		Alumina		Fertilizer		Subtotal	
Year	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
1990 Actual	386		465		254		1,587		47		2,739	
2000 Actual	285		436		460		1,223		136		2,540	
Forecast												
2010	-	271	441	561	468	572	1,002	1,275	135	162	2,046	2,841
2020	-	263	435	708	485	733	855	1,394	128	175	1,904	3,273
2030	-	258	418	772	482	809	768	1,417	123	174	1,792	3,430
Compound Annual Growth Rates												
1990-2000	-3.0%		-0.6%		6.1%		-2.6%		11.2%		-0.8%	
2000-2010	-9.0%	-0.5%	0.1%	2.6%	0.2%	2.2%	-2.0%	0.4%	-0.1%	1.8%	-2.1%	1.1%
2010-2020	0.0%	-0.3%	-0.1%	2.4%	0.4%	2.5%	-1.6%	0.9%	-0.5%	0.8%	-0.7%	1.4%
2020-2030	0.0%	-0.2%	-0.4%	0.9%	-0.1%	1.0%	-1.1%	0.2%	-0.4%	0.0%	-0.6%	0.5%
2000-2030	NM	-0.3%	-0.1%	1.9%	0.2%	1.9%	-1.5%	0.5%	-0.3%	0.8%	-1.2%	1.0%

Source: BST Associates, DRI-WEFA

Table 49 – Dry Bulk Coastwise Receipt Forecasts (1,000s of Metric Tons)

	Wood Chips	
Year	**Low**	**High**
1990 Actual	413	
2000 Actual	419	
Forecast		
2010	387	488
2020	362	576
2030	336	608
Compound Annual Growth Rates		
1990-2000	0.1%	
2000-2010	-0.9%	1.5%
2010-2020	-0.8%	1.7%
2020-2030	-0.7%	0.5%
2000-2030	-0.7%	1.2%

Source: BST Associates, DRI-WEFA

KEY EXPORT COMMODITIES

The following section provides additional insights into key commodities.

Soda Ash Exports

For more than two centuries soda ash has been a key chemical for producing glass and soap and for bleaching fabrics and paper. For most of this period soda ash was produced by one of two chemical processes. However, in 1938, extensive soda ash-rich deposits of trona were found in the Green River area of Wyoming. Extracting soda ash from trona proved to be considerably cheaper than manufacturing using other methods, and production from these deposits began in the late 1940's. Production of soda ash from trona gradually took over the North American market. In 1986 the last of the U.S. chemical-process plants closed, and in 2001 the last Canadian plant closed.

The United States contains essentially all of the world's known deposits of naturally occurring soda ash and supplies more than 96% of the world market for natural soda ash. Worldwide, however, chemically produced soda ash is still widely used, and more than two-thirds of world production uses this method. Soda ash is a relatively low-value item, so customers must balance the higher cost of chemically produced soda ash with the higher transportation cost for that which occurs naturally. In addition, high tariffs protect local industry in some countries.

According to the USGS, the United States industry was comprised of four companies (with five plants) in Wyoming, one company (with 1 plant) in California, and one company (with 1 plant) in Colorado. These producers had a combined annual capacity of 14.5 million tons, and represent the largest production in the world.

Exports account for nearly 40% of U.S. soda ash production, and U.S. soda ash was sent to 47 different countries in 2000. Asia is the largest market, followed by Canada and Latin America. Exports to Asia have been affected in recent years by the economic problems in that region, and, in addition, China is increasing its production capacity. According to the USGS, the top 10 countries represented 72% of U.S. soda ash exports. In order, these were: Mexico, 16%; the Republic of Korea, 10%; Japan, 9%; Brazil, 7%; Indonesia, 6%; Taiwan, 5%; Venezuela, 5%; Chile, 4%; and Thailand, 4%.

According to the USGS, the outlook for soda ash for the next 5 years is favorable. Domestic soda ash is expected to grow between 0.5% and 1.0% per year, and world demand is forecast to range from 2.0% to 2.5% per year for the next several years. Because the glass container sector is the largest soda-ash-consuming sector, the demand for soda ash for glass containers may decline as consumers slowly accept their food and beverages packaged the newer PET containers. Asia and South America remain the likeliest areas for increased soda ash consumption in the near future.

Columbia River soda ash exports increased at 5.2% per year between 1990 and 2000 but slowed to 0.6% in the last six years. MARAD data shows that soda ash moves through all of the Columbia River ports, but the majority moves via Portland. The Columbia River accounted for 72% of soda ash exports during the period from 1990 to 2000, but market share increased to nearly 75% during the period 1995 to 2000. Soda ash from Wyoming also moves via the Gulf Coast ports to Atlantic Ocean destinations.

The Columbia River accounted for the majority of most Pacific Rim markets: 89% of NE Asia, 92% of SE Asia, 93% of Oceania, 83% of India and Other Asia, 92% of the Middle East, 69% of Central America.

The volume of soda ash moving through Southern California ports is about one-quarter the size of Columbia River exports. Essentially all of this product originates at the California facility, which is located near Death Valley, and most of it moves through the Port of San Diego. Gulf coast ports also handle significant volumes of soda ash exports.

The forecast calls for Lower Columbia River soda ash exports to increase from 2.2 million tons in 2000 to between 2.2 million tons (low) and 4.0 million tons (high) in 2030, representing average annual growth of 0.0% (low) and 2.0% (high).

Potash Exports

"Potash" refers to a group of natural and man-made mineral fertilizers, all of which are based on potassium. Specifically, the term potash has been used to indicate potassium chloride, potassium sulfate, and potassium-magnesium sulfate, as well as muriate of potash and Lemery salt.

Potash is produced worldwide, with North America and the Former Soviet Union being the largest producers. Combined, these two regions account for nearly 70% of production. Canada and the former Soviet Union are also the major world exporters of potash.

Asia imports more potash than any other region, and the largest share of this market is supplied by the former Soviet Union. However, North America is also a major supplier of potash to Asia. North America is the second-largest import market for potash, and this trade consists almost entirely of shipments from Canada to the United States. Europe represents the third-largest market, and Europe imports nearly as much potash as the North America. This market is supplied mainly from within Europe, but the former Soviet Union is also a major supplier. In addition, small amounts are shipped to Europe from North America and other producers.

Table 50 Two-Way Potash Trade, 1999 (millions of U.S. $)

	Exporters							
Importers	**Africa**	**North America**	**Latin America**	**Asia**	**Europe**	**Former USSR**	**Oceania**	**Total**
Africa	2.5	2.2	4.8	4.7	69.6	43.3	0.0	127.2
North America	0.0	776.5	2.0	0.5	13.3	30.5	0.1	822.8
Latin America	-	171.1	19.8	0.0	147.0	131.7	-	469.6
Asia	0.1	478.5	9.1	250.1	93.1	645.1	0.2	1,476.2
Europe	0.0	38.7	8.0	26.6	504.6	177.6	0.0	755.6
Fm USSR	-	-	0.1	0.2	0.7	22.3	-	23.4
Oceania	0.0	58.9	0.9	6.1	17.5	-	0.7	84.1
Total	2.6	1,525.9	44.6	288.2	845.9	1,050.5	1.0	3,758.9

Source: BST Associates, using data from Statistics Canada

Latin America is the fourth-largest import market for potash. While North America is the largest supplier, Europe and the Former USSR are not far behind. Africa is a relatively

small market, supplied mainly by Europe and the Former USSR, while Oceania is a small market supplied mainly by North America.

According to the USGS, in 2001 "the world's largest potash producers operated at reduced capacity for another year owing to potential oversupply. The Canadian potash industry operated for the first half of the year at about 70% of capacity, which was an increase from the first half of 1999. Production declined slightly the second half of the year. Potash producers in the former Soviet Union continued operating at reduced capacity while many other producers around the world operated at normal capacity. Belarus, Germany, and Russia faced marginally increasing demand in their home markets."

In Canada, 92% of production takes place in Saskatchewan, and the remainder in New Brunswick. Saskatchewan is the source of the potash exported through Portland. Canpotex Ltd., a partnership of the three Canadian potash producers, is responsible for offshore sales of the Saskatchewan potash. Canpotex owns a stake in two terminals, at the ports of Vancouver (BC) and Portland. According to PotashCorp, one of the owners of Canpotex, the ore body in Saskatchewan is one of the richest and most economical in the world. With world demand growing by about 2% annually and 80% of world capacity already in production there is excellent potential for growth from this area.

Due to labor problems at Vancouver, BC, Canpotex saw the need to develop an alternative gateway to Vancouver. Portland was chosen, and a new export facility completed in 1997. This facility now handles nearly one-third of Canpotex West Coast exports. In addition to providing a hedge against labor problems, the use of the Union Pacific provides rail competition, which results in inland lower transportation costs. Some potash is also exported via Longview.

Table 51 – PNW Potash Export Trends (1,000s of Metric Tons)

Year	Vancouver Port Corp	Portland	Longview	Total	Col River Share
1992	2,775		167	2,942	5.7%
1993	2,742		144	2,886	5.0%
1994	4,105		235	4,340	5.4%
1995	4,435		477	4,912	9.7%
1996	3,749		171	3,920	4.4%
1997	4,281	602	79	4,962	13.7%
1998	3,414	1,415	139	4,968	31.3%
1999	3,395	1,563	45	5,003	32.1%
2000	3,889	1,767	44	5,701	31.8%

Source: BST Associates using data from VPC and Port of Portland

Future growth opportunities are constrained by the low value of the Canadian dollar, which makes exports via BC relatively less expensive than through Portland. The forecast calls for potash exports to increase from 1.9 million tons in 2000 to between 1.5 million tons (low) and 2.9 million tons (high) in 2030, representing average annual growth of -0.6% (low) and 1.6% (high).

Bentonite Clay Exports

Bentonite is a soft clay substance composed essentially of clay minerals of the montmorillonite group and is formed from chemical weathering of volcanic materials such as tuff or glass, volcanic ash, other igneous rocks, or from rocks of sedimentary origin. There are two basic types of bentonite, depending on whether they contain sodium or calcium in the crystal lattice. Swelling bentonite contains sodium and has the ability to swell to many times its dry volume when wet and possesses a high dry-bonding strength. Non-swelling bentonite, which contains calcium, has a far lower capacity to swell when wet.

According to the University of Saskatchewan, swelling bentonite is used for well-drilling mud, for binding iron ores before smelting, as a binder and digestive aid in animal feed, as a sealing agent for reservoirs, lagoons and other engineering projects, as a binder of foundry sand, and as absorbent material for cat litter, among other uses. Some non-swelling bentonites, can be altered by acid leaching to render them useful as catalysts for petroleum cracking or for bleaching animal litter such as cat litter. They can also be used as a binder in foundry molds, although the swelling type is preferable.

According to the USGS, in the United States the bonding of foundry sand is the leading use of bentonite clay, followed closely by pet waste absorbent (i.e., kitty litter). Drilling mud and iron ore palletizing also consume substantial volumes of bentonite. The major domestic uses for non-swelling bentonite, in decreasing order, were in foundry sand; clarifying, decolorizing and filtering of oils and greases; catalyst; miscellaneous absorbents; animal feed; and chemical manufacture. Exports were limited to foundry sand and miscellaneous unknown applications.

Table 52 – Domestic Uses of Bentonite Clay

Use of Bentonite Clay	Percent
Foundry sand bond	24%
Pet waste absorbent	22%
Drilling mud	18%
Iron ore palletizing	15%
Other uses	21%

Source: USGS

World production of bentonite was approximately 9.82 million tons in 1999. The United States was responsible for more than 40% of world output, while the top eight producing countries produced more than 80% of the world total. Greece, the former USSR and Turkey are the three next-biggest producers, and combined with Ukraine (ranked 8th) form a major bentonite-producing region. Western Europe also produces large volumes of bentonite, with Germany and Italy combined to produce 10% of world output. According to the USGS data China is the largest producer of bentonite in Asia. However, USGS acknowledges that there is not enough reliable information to allow an estimate of China's output, even though China is known to produce bentonite. This is also the case with Canada.

In 1999, 21 companies produced bentonite from approximately 70 quarries in 11 States. Six producers were large, diversified firms with international mineral operations or interests in other types of clay in the United States (USGS). According to the Wyoming State Geological Society, most of the sodium (swelling) bentonite mined in the U.S. is mined in

Wyoming. The remainder is mined adjacent to Wyoming in Montana and South Dakota. Nearly 3.70 million metric tons of bentonite were mined in Wyoming in 1999 and nearly 3.8 million tons in 2000, according to the State Inspector of Mines of Wyoming. U.S. production of swelling bentonite totaled 3.68 Mt in 1999. These two sources may not be directly comparable, but it is obvious that the majority of swelling product comes from Wyoming. The remainder is mined in Montana, Utah, Texas, California, Oregon, and Nevada. The Utah Geological Society estimates that 55,000 metric tons of bentonite were mined in Utah in 2000, while USGS estimates 23,000 metric tons for California, 6,000 metric tons for Nevada, and 11,000 metric tons for Oregon, with volume data withheld in Texas and Montana.

Columbia River bentonite clay exports grew from 265,000 tons in 1990 to a peak of 303,800 tons in 1994 then fell to 205,100 tons by 2000, representing a decline of -2.5% per year between 1990 and 2000. The Columbia River accounted for 41% of bentonite clay exports during the period from 1990 to 2000, but market share decreased to about 35% during the period 1995 to 2000. Some bentonite clay also moves (via container) through Puget Sound and Southern California ports. Smaller volumes also move through other port regions. The Columbia River accounted for the following market share: 74% of NE Asia, 20% of SE Asia, and 87% of the Middle East.

The forecast calls for exports of bentonite clay to increase from 205,000 tons in 2000 to between 215,000 tons (low) and 361,000 tons (high) in 2030, representing average annual growth of 0.2% (low) and 1.9% (high).

Other Exports

The other two major dry bulk export are ores/concentrates and petroleum coke.

Ores/concentrates consist of copper products mined in Utah. Product volumes have declined from 197,000 tons in 2000 to just 45,000 tons in 2000. Future growth is expected to be modest with volumes ranging from 25,000 ton (low) to 66,000 tons (high) by 2030.

Petroleum coke is produced at a refinery in Cherry Point (located north of Bellingham in Washington) and railed to Longview for export. Export volumes have increased from 408,000 tons in 1990 to a peak of 620,000 tons in 1995, declining to 537,000 tons in 2000. Exports have increased in the past two years as coke was diverted from idled aluminum smelters to export markets. The forecast calls for pet coke to range from 462,000 tons (low) and 643,000 tons (high) in 2030. However, these shipments could be further reduced if rail rates increased and/or another dry bulk terminal were constructed at Cherry Point.

KEY IMPORT COMMODITIES

The following section provides additional insights into key commodities.

Alumina Imports

Alumina is imported into the United States primarily as a raw material for aluminum manufacturing. Alumina is not a natural occurring ore, but is instead produced by processing bauxite ore, which does occur naturally, into alumina. Of all bauxite mined, approximately 85% is converted to alumina for the production of aluminum metal

According to the USGS, in 2000, Australia, Brazil, Guinea, and Jamaica accounted for about 70% of the total bauxite mined in 2000. A large share of bauxite ore is refined near the mine to produce alumina, but a significant volume of the raw material is shipped overseas for processing into alumina. The major producers of alumina in 2000 were Australia, the United States, China, and Jamaica.

In 1990, Latin America and Europe were the world's largest exporters of alumina and aluminum ores. Over the past decade, however, Oceania has jumped from a non-player to taking more than one-third of the world market. Over the same period, the volume of Latin American exports grew by nearly 40%, while market share grew from 30.5% to 35.7% then declined to 26.9%. European export volume dropped by approximately 20%, and market share fell from 29.8% to 15.5%. Africa and North America also export alumina and aluminum ores, but in volumes only half as big as those of Europe.

North America and Europe are the biggest markets for alumina and aluminum ores, each accounting for approximately one-third of the market. Asia accounts for 12% of the market, and the rest is split between Africa, the Former USSR, Oceania, and Latin America.

In North America there are 35 smelters for converting alumina into aluminum. Of this total, 24 are located in the United States and 11 in Canada. The Canadian industry is clustered in Quebec, where cheap hydropower makes the production of aluminum economically feasible. Cheap hydropower is also one of the main reasons that 10 of the 24 U.S. smelters and one of the Canadian smelters are located in the Pacific Northwest and British Columbia. Most of the remaining U.S. smelters are located along the base of the Appalachian Mountains, or along the inland waterway system of the Mississippi and Ohio Rivers.

Alumina imports to the Columbia River region from Australia ranged between 900,000 tons and 1.6 million tons during the past decade. The annual growth rate during the period 1990 to 2000 was –2.6% but the rate climbed during the period 1995 to 2000 to +2.2% per year. These imports were split between Portland, Vancouver and Longview based upon the requirements of the aluminum smelters. The Lower Columbia Region accounted for average of 7.8% of alumina imports into the U.S. during the past decade, slightly more than the Puget Sound share. Virtually all alumina imported to the PNW comes from Australia.

High energy costs and low product prices are causing aluminum companies to seriously evaluate which plants will continue to operate in the Pacific Northwest. A permanent closure of any of the smelters may lead to a decline in alumina imports. However, these plants have shown remarkable resiliency. The forecast calls for alumina imports to range from 768,000 tons (low) and 1.4 million tons (high) in 2030.

Salt Imports

While food is the best-know use of salt, the chemical industry is actually the largest consumer, using nearly half of all salt used in the United States. The manufacture of chloralkalis is the main chemical use, which produces chlorine, caustic soda and synthetic soda ash, among other product. Worldwide, soda ash is the most common use, but in the United States, which has large natural deposits of soda ash, caustic soda is the leading use of salt. Other major uses of salt include food-processing, fabric dyeing, oil exploration, metal processing, leather tanning, rubber manufacturing, water treatment, and road de-icing. In

the Pacific Northwest, most salt is used in manufacturing caustic soda for the pulp and paper industry.

Imports of salt climbed steadily over the last decade. Nationwide, imports grew at an annual average rate of 5.0% from 1990 through 2000. The rate was even higher over the last half of the decade, averaging 6.3% per year. However, in the Columbia River, salt imports dropped over the same time period, with average declines of –3.0% per year from 1990 through 2000. Over the second half of the decade imports stabilized, recovered slightly by the end of the decade. Environmental concerns over the use of salt-based chemicals for bleaching pulpwood are a major reason for this decline, along with cyclical business patterns in the paper industry.

The environmental effects of chlorine have been a hot topic for the past decade. According to the American Institute of Chemical Engineers, the environmental effects from the industrial use of chlorine chemicals, of which caustic soda is one, "first got mainstream attention in 1992 when the International Joint Commission (IJC), a group that advises the United States and Canadian governments on Great Lakes environmental issues, published a report calling for industry and government to develop timetables for the phase out of all uses of chlorine. In response, the Chlorine Zero Discharge Act set a 5-year deadline for the elimination of chlorine from the pulp and paper industry. These events created quite a furor, as those in favor of a chlorine phase out, mainly environmental groups, applauded the decision and published reports and press releases detailing the evils of chlorine. Those most adamantly opposing a chlorine ban, represented by members of the chemical industry, refuted the claims as scientifically unsubstantiated and emphasized the widespread use and benefits provided by chlorine; advocating banning or restricting only those chemicals which exhibited unreasonable effects, the industry pointed to the wide spectrum of properties of chlorinated compounds."

Though the debate over chlorine continues, it is not likely that salt consumption by the pulp and paper industry will ever reach historic levels again. This is especially true in the Pacific Northwest, where environmental concerns have combined with economic conditions to reduce the number of pulp mills still operating. The forecast calls for salt imports to range from 0 tons (low) and 258,000 tons (high) in 2030.

Limestone, Cement, and Aggregate Imports

Limestone, cement and aggregate are all shipped through the Columbia River for use in the construction industry. Because the three commodities are so closely tied, they discussed together in the following section.

Crushed stone, one of the most accessible natural resources, is a major basic raw material used by construction, agriculture, and other industries that use complex chemical and metallurgical processes. Despite the low value of its basic products, the crushed stone industry is a major contributor to the economy. A total of 1.56 billion metric tons of crushed stone was produced for consumption in the United States in 2000, the highest production level ever recorded.

About 70% of crushed stone production continued to be limestone and dolomite, followed, in descending order of tonnage, by granite, trap rock, sandstone and quartzite, miscellaneous stone, marble, slate, calcareous marl, shell, and volcanic cinder and scoria. Nationwide,

foreign trade of crushed stone is relatively limited. In the Pacific Northwest, however, imports of limestone supply a major share of consumption.

Aggregates, specifically sand and gravel, are generally not imported to the Lower Columbia River. Most of the waterborne movements of aggregates on the Columbia River are between origins and destinations that are both located on the river system.

Hydraulic cements are those that can set and harden under water and are dominated by varieties that can be loosely grouped as Portland cement and masonry cement. Cement manufacturing is a major use of limestone imported into the Pacific Northwest. Foreign countries are also major sources of cement, and much of the cement used in the Pacific Northwest is imported. The United States continued to rank third in the world in overall hydraulic cement output, behind China (about 36% of the world's total) and India. China is the primary overseas supplier shipping via water to the Pacific Northwest, although Canada ships cement by rail and barge from British Columbia to Washington and Oregon.

Concrete is one of the most important building materials used in the world today. When looking at the construction materials trade, however, it is important to distinguish between different types of materials. Two of the most commonly confused terms are "concrete" and "cement". In the following section, each of these is described in detail.

According to Portland Cement Association, in its simplest form, concrete is a mixture of paste and aggregates. The paste, composed of Portland cement and water, coats the surface of the fine and coarse aggregates. Through a chemical reaction called hydration, the paste hardens and gains strength to form the rock-like mass known as concrete. Typically, a mix is about 10 to 15 percent cement, 60 to 75 percent aggregate and 15 to 20 percent water. "Cement", therefore, is one of the key ingredients in "concrete".

The name "Portland cement" was created by its inventor in 1824, a British stone mason named Joseph Aspdin. Because he product he created resembled a stone quarried on the Isle of Portland off the British Coast, the name was applied.

Concrete is produced in four basic forms, each with unique applications and properties. Ready-mixed concrete, by far the most common form, accounts for nearly three-fourths of all concrete. Precast concrete products are cast in a factory setting, and include such products as concrete bricks, paving stones and bridge girders, structural components, and panels for cladding. Concrete masonry includes such products as the standard 8 x 8 x 16-inch block. Finally, a new generation of advanced products incorporates fibers and special aggregate to create roofing tiles, shake shingles, lap siding, and countertops. And an emerging market is the use of cement to treat and stabilize waste. (Source: Portland Cement Association).

The primary raw material for cement manufacture is calcium carbonate or limestone. This is obtained from the quarry where crushing reduces the rock to stone less than 25 mm in diameter. Most modern cement factories are located close to a source of limestone as about 1.5 tons of limestone are needed to produce one ton of cement.

Next, the crushed limestone is mixed with other ingredients, usually shale, iron ore and sand, then the mixture is fed into mills where steel balls grind the material to a fine powder called raw meal. This mixture is then fed into huge rotary kilns. At the opposite end of the kiln pulverized coal is burned to slowly raise the temperature of the mixture to 1,450 °C. At

this point clinkering occurs, which creates hardened nodules of cement. (Clinker is the most common form of concrete traded on world markets.) Finally, steel balls are again used to grind a mixture of clinker and a small quantity of gypsum into a fine powder, which is then called cement. Without gypsum, cement would flash set when water is added and gypsum is therefore required to control setting times. (Source: PPC Cement Manufacturing)

The leading producing states, in descending order of tonnage, were Texas, Florida, Missouri, Ohio, and Pennsylvania; these five States accounted for 40% of the total U.S. output. Oregon and Washington produce relatively little limestone. Washington's 14 quarries produced just over 2 million metric tons, while Oregon's two quarries, whose production figures are suppressed, most likely produced much less. The limited local production in Oregon and Washington is the major reason that limestone is imported into the region.

According to the USGS, the U.S. cement industry is significantly dependent on imports. The average unit value of imports averaged $48.72 per ton, of which the base value was $37.44 per ton and combined shipping and insurance costs were $11.28 per ton. In the Lower Columbia River, in 2000 all cement imports came from China. Ten years ago China exported no cement to the Lower Columbia River, and Japan accounted for all of the imports. In 1995 South America sent a small quantity of cement to the Lower Columbia River,

Texada Island, 50 miles north of Vancouver, B.C., is a major source of limestone for the Pacific Northwest. Three quarries currently operate there and ship limestone by water. These include: Ash Grove Cement, which sells aggregates, agricultural limestone and also cement rock to their cement plant in Seattle, Washington, as well as chemical grade limestone to their Rivergate lime plant in Portland, Oregon; Lafarge Corporation, which supplies to Seattle; and Imperial Limestone, based in Seattle.

Four concrete firms serve the Lower Columbia River region: Ash Grove, Glacier Northwest, LaFarge, and Tilbury.

Ash Grove has a plant at Rivergate in Portland that produces a number of limestone-based products, but no cement. Commodities that are produced at this plant include calcium oxide, calcium hydroxide, ground limestone, agricultural lime, ground dolomite, dolomitic rock, and commercial limestone. Ash Grove does operate the only cement-manufacturing plant in Oregon, located in Durkee, near the Idaho border. Cement used by Ash Grove in Portland is either shipped in by rail from Durkee, or is barge from Seattle.

Glacier Northwest imports all of its cement from overseas suppliers. LaFarge, located in Vancouver, WA, ships cement in by rail or barge, from Richmond, BC. Tilbury ships by rail from Delta, BC.

The outlook for the crushed stone industry, as well as that for cement and aggregates, is closely tied to the health of the economy and especially to the health of the construction industry. According to the USGS, demand for crushed stone was expected to increase 2.5% in 2001. For cement, industry analysts expected stagnant or declining market conditions in 2001, followed by a small decline in demand for the next year or two, followed by a resumption in steady demand growth, albeit at modest rates of 1% to 3% per year, for the next few years thereafter.

In the Pacific Northwest, the short-term outlook for construction material is probably worse than for the nation as a whole. The relatively poor state of the regional economy has severely impacted public construction budgets, which will limit either limit increases in sales of construction materials.

Gypsum Imports

Gypsum is one of the most widely used minerals in the world. In the United States, most gypsum is used to manufacture wallboard for homes, offices, and commercial buildings. Gypsum is also used in the manufacture of Portland cement and as a soil conditioner.

There are two sources of gypsum used to manufacture wallboard - natural gypsum mined from the ground and synthetic gypsum, a byproduct of the flue gas desulfurization process used by power-generating plants to remove polluting gases from smokestacks. In order to be made into wallboard, the natural or synthetic gypsum undergoes a series of drying and crushing steps to produce a fine stucco powder. This stucco powder is then mixed with water into a paste, and spread onto continuous sheets of front and back paper. The continuous sheets are then cut into standard sizes, stacked and shipped to customers.

Nearly 80% of the gypsum used in the U.S. goes into the manufacture of prefabricated products, namely wallboard. Another 13% is used in the manufacture of cement, and 7% for agriculture. Uncalcined gypsum, which is gypsum that has only been surface-dried, is mainly used for cement and agriculture. Calcined gypsum has been extensively dried and crushed into a fine powder, and is primarily used in creating wallboard or plaster.

Most of the gypsum mining in the U.S. occurs in the central part of the country, with mines located in the Mountain West, Great Plains, and Midwest. There are also a number of mines in the Northeast and South and Southwest. The only regions that do not have gypsum mines are the Southeast and the Pacific Northwest. Because of this, most of the gypsum used in the Pacific Northwest is transported in via water.

After a record setting year in 1999, the gypsum industry in the United States experienced a decline in both production and consumption in 2000. In addition, crude gypsum and wallboard imports declined in 2000. Synthetic gypsum generated by various industrial processes continued to increase as a raw material source for wallboard plants.

In June of 2000, U.S. Gypsum opened a new plant in Rainier, OR, which uses natural gypsum imported from Mexico. James Hardie Gypsum also announced plans to build three new joint treatment manufacturing plants; the first of the three started operations in the last quarter of 2000 in Kent, WA. Wallboard is fairly high-weight, low-value product, so the closer to the end user it can be manufactured, the lower the transportation costs will be. (USGS)

LIQUID BULKS

The following section provides forecasts for liquid bulk cargoes moving through Lower Columbia River ports.

HISTORICAL TRENDS

Refined Petroleum Products

The Lower Columbia River region has no oil refineries, so all of the gasoline, diesel fuel, jet fuel, heating oil and other refined petroleum products must be shipped to the area. Most of petroleum products used in this region, as well as in most of Oregon, originate at refineries on Puget Sound. They are shipped to the region primarily by pipeline or by water. In addition, some petroleum products are shipped to the area by water from California.

Refined petroleum products consist of two broad categories:

- Gasoline, kerosene, distillate, and like products are received by pipeline or barge/vessel. These products increased from 1.1 million tons in 1990 to 6.2 million tons in 2000, but much of the increase (in 1999/2000) was caused by the shutdown of the Olympic Pipeline. This pipeline, which connects the refineries in northern Puget Sound with Vancouver and Portland, has since re-opened.
- Other refined products (residual fuel oil, lube oil & greases, naphtha & solvents, and asphalt, tar & pitch), which are received by barge/vessel. These products decreased from 1.1 million tons in 1990 to 650,000 tons in 2000.

Table 53 – Lower Columbia River Receipts of Refined Petroleum Products (1,000s of tons)

	Gasoline, distillates etc.			Other Refined Prds			All Prds		
Year	Imports	Coastwise Receipts	Total	Imports	Coastwise Receipts	Total	Imports	Coastwise Receipts	Total
1990	166	977	1,143	88	979	1,067	254	1,956	2,210
1991	186	943	1,129	202	1,051	1,253	388	1,994	2,382
1992	212	1,073	1,285	78	733	811	290	1,806	2,097
1993	70	1,754	1,823	103	810	913	172	2,564	2,736
1994	88	1,845	1,933	71	684	755	159	2,529	2,688
1995	38	1,843	1,882	93	649	742	132	2,492	2,624
1996	101	2,267	2,368	89	637	726	190	2,904	3,094
1997	144	1,935	2,079	102	622	724	246	2,557	2,803
1998	220	2,102	2,322	121	515	636	341	2,617	2,958
1999	780	3,363	4,143	204	480	684	984	3,843	4,827
2000	381	5,806	6,187	217	436	653	598	6,242	6,840
Compound Annual Growth Rates									
1990-2000	8.7%	19.5%	18.4%	9.4%	-7.8%	-4.8%	8.9%	12.3%	12.0%

Source: BST Associates, DRI-WEFA

Most of the domestically supplied petroleum products that are shipped to Oregon by water originate in Washington. In 2000, Washington accounted for approximately three-quarters of all waterborne receipts of petroleum products, and California the other quarter. A very small amount of refined product is also shipped to the area from Alaska, but this amounts to less than 1% of domestic receipts.

Table 54 – Domestic Sources of Waterborne Petroleum Products (1,000s of tons)

State of Origin	Tons	Share
Alaska	43	0.7%
California	1,636	25.9%
Washington	4,627	73.4%
Total	6,305	100.0%

Source: BST Associates using data from USACE Waterborne Commerce statistics

Crude Oil

Crude oil is received from domestic and foreign producers as an input to asphalt production at Lower Columbia River plants. Receipts of crude oil increased from 126,000 tons in 1990 to 309,000 tons in 2000. However, it should be noted that 1990 was a low year relative to all other years. An increasing share of crude oil receipts is coming from foreign sources.

Table 55 – Lower Columbia River Receipts of Crude Oil (1,000s of tons)

Year	Imports	Coastwise	Total
1990	55	71	126
1991	249	152	401
1992	359	87	446
1993	357	8	365
1994	233	64	297
1995	202	130	332
1996	170	63	232
1997	311	36	347
1998	357	30	386
1999	232	24	257
2000	297	13	309
Compound Annual Growth Rates			
1990-2000	18.3%	-15.8%	9.4%

Source: BST Associates, DRI-WEFA

Chemicals & Fertilizers

The Lower Columbia River region also receives and ships chemicals and fertilizers.

Receipts

The two primary receipts are nitrogenous fertilizers and benzene/toluene. Nitrogenous fertilizers have declined from 344,000 tons in 1990 to 228,000 tons in 2000. The decline is expected due to an increase in domestic production of these products near the Tri-Cities.

Benzene and toluene, which are inputs to chemical manufacturing processes, have remained relatively stable at 55,000 tons in 1990 and 2000.

Other receipts of liquid bulks include alcohols, ammonia and other hydrocarbons. These products disappeared in 2000.

Table 56 – Lower Columbia River Receipts of Chemicals (1,000s of tons)

	Nitrogenous Fertilizers			Benzene & Toluene			Other Coastwise Receipts				
Year	Coastwise Receipts	Imports	Total	Coastwise Receipts	Imports	Total	Other Hydro-carbons	Alcohols	Ammonia	Subtotal	Total
1990	290	54	344	8	47	55	-	4	46	50	449
1991	174	50	224	-	35	35	-	6	73	80	339
1992	112	32	144	7	24	32	6	13	180	200	376
1993	169	54	222	24	33	56	3	14	245	262	540
1994	146	23	169	31	24	55	-	11	216	227	451
1995	115	39	154	31	18	49	6	12	198	217	420
1996	87	42	129	46	18	64	-	-	41	41	234
1997	79	62	141	81	5	86	-	5	93	149	375
1998	127	195	322	62	14	75	-	24	24	48	445
1999	94	145	240	67	20	87	-	2	36	38	365
2000	67	161	228	32	24	56	-	-	-	-	284
Compound Annual Growth Rates											
1990-2000	-13.6%	11.6%	-4.0%	14.5%	-6.3%	0.2%	NM	-100.0%	-100.0%	-100.0%	-4.5%

Source: BST Associates, DRI-WEFA

Shipments

Lower Columbia River plants also ship nitrogenous fertilizers, alcohols, ammonia and sodium hydroxide. These products increased from 1990 to a peak in 1993 and have since fallen consistently. The decline in nitrogenous fertilizers mirrors the decline in coastwise receipts since more of the required shipments are being produced in the region. Shipments of sodium hydroxide decreased due to less demand in the paper industry for bleaching agents.

Table 57 – Lower Columbia River Shipments of Chemicals (1,000s of tons)

Year	Nitrogenous Fert.	Alcohols	Ammonia	Sodium Hydroxide	Subtotal
1990	24.5	0	11.8	96.2	132.5
1991	0	0	0	114.3	114.3
1992	10	7.3	0	109.8	127.1
1993	13.6	14.5	0	165.1	193.2
1994	3.6	23.6	0	121.6	148.8
1995	1.8	23.6	0	148.8	174.2
1996	50.8	5.4	0	109.8	166.0
1997	67.1	34.4	0	61.7	163.2
1998	58.9	20.8	9.1	43.5	132.3
1999	41.7	11.8	20.8	26.3	100.6
2000	14.5	7.3	-	9.1	30.8
Compound Annual Growth Rates					
1990-2000	-5.1%	NM	NM	-21.0%	-13.6%

Source: BST Associates, DRI-WEFA

FORECASTS

Refined Petroleum Products

Four pipelines carry refined petroleum products in Oregon and Washington: the Olympic Pipeline, Chevron Pipeline, Yellowstone Pipeline, and Kinder Morgan Pipeline. Of these, the Olympic Pipeline is the most important. This line runs from the refineries on Puget Sound as far south as Portland, and has distribution terminals located at Bayview (Mount Vernon), Seattle, Renton, Sea-Tac, Tacoma, Spanaway, Olympia, and Vancouver in Washington, as well as Linnton and Portland in Oregon. The throughput capacity for this line is approximately 4.6 billion gallons per year, and it carries gasoline, diesel fuel and jet fuel. As indicated previously, the growth rate of refined product receipts by water between 1990 and 2000 was distorted by the explosion of the Olympic pipeline in June of 1999. This pipeline carries a relatively large share of the refined products shipped to the Portland area (estimated at 1.8 million tons in 2000), and with it out of commission shippers resorted to moving product via water. The pipeline was restarted in June of 2001, but is still operating at only 80% of capacity.

The Chevron Pipeline runs between Salt Lake City and Pasco, with an extension connecting Pasco with Spokane. Currently the line transports refined product from a Utah refinery to Boise and Pasco. However, Chevron has announced plans to reverse flow in the line in order to supply Boise from Pasco. After the line is reversed, refined product will originate

in the Portland area and be shipped to Pasco via barge. Up to 20,000 barrels a day of gasoline and other products to could flow from Pasco to Boise[9].

The Yellowstone Pipeline runs from Billings, Montana to Spokane and Moses Lake, Washington. The pipeline now supplies approximately 34 percent of all consumer gasoline and diesel fuel to the Spokane market, 100 percent of the military jet fuel to Fairchild Air Force Base, and 100 percent of the commercial jet fuel to the Grant County Airport.

The Kinder Morgan Pipeline runs from Portland to Eugene, and supplies virtually all of the gasoline used in the Willamette Valley

The following forecast for refined product receipts assumes that the overall market for refined products in the Lower Columbia region (and its hinterland) grows at between 1.0% to 1.7% per year for the period 2000 to 2010, then declines to 0.5% to 1.1% per year for the next decade and remains constant at this level until 2030. This assumption implies that alternative technologies and/or conservation (high CAFÉ standards among other factors) will be increasingly applied over time.

Table 58 – Lower Columbia River Refined Petroleum Product Forecasts (1,000s of tons)

	Coastwise Receipts		Imports		Total	
Year	**Low**	**High**	**Low**	**High**	**Low**	**High**
1990 Actual	1,956		254.0		2,210	
2000 Actual	6,242		598.0		6,840	
Forecast						
2010	3,667	4,582	489	514	4,156	5,096
2020	4,008	5,286	534	593	4,542	5,879
2030	4,008	5,141	534	577	4,542	5,718
Compound Annual Growth Rates						
1990-2000	12.3%		8.9%		12.0%	
2000-2010	-5.2%	-3.0%	-2.0%	-1.5%	-4.9%	-2.9%
2010-2020	0.9%	1.4%	0.9%	1.4%	0.9%	1.4%
2020-2030	0.0%	-0.3%	0.0%	-0.3%	0.0%	-0.3%
2000-2030	-1.5%	-0.6%	-0.4%	-0.1%	-1.4%	-0.6%

Source: BST Associates, DRI-WEFA

It is further assumed that the Olympic Pipeline is constrained under the low growth scenario and grows modestly at 0.5% per year under the high growth scenario. Waterborne receipts are equal to the residual of the total market growth less the volumes carried by the pipeline. Under these assumptions, waterborne receipts are expected to decline to 3.6 (low) and 4.6 (high) million tons in 2010 and then increase slightly during the period 2010 to 2020, remaining at these levels for the remainder of the study period. Imports are expected to grow slightly more rapidly than coastwise receipts.

[9] This project has been tabled but may be revived later according to a company spokesman.

Crude Oil

Crude oil receipts are expected to increase in line with construction activity in the Lower Columbia River region. The forecast calls for receipts increase at between 0.6% (low) and 1.6% (high) per year through the end of the study period, reaching between 373,000 tons (low) and 501,000 tons (high) in 2030.

Table 59 – Lower Columbia River Crude Oil Forecasts (1,000s of tons)

	Coastwise Receipts		Imports		Total	
Year	**Low**	**High**	**Low**	**High**	**Low**	**High**
1990 Actual	71		55		126	
2000 Actual	13		297		309	
Forecast						
2010	13	15	318	362	331	376
2020	14	17	341	428	355	445
2030	14	18	359	482	373	501
Compound Annual Growth Rates						
1990-2000	-15.8%		18.3%		9.4%	
2000-2010	0.5%	1.5%	0.7%	2.0%	0.7%	2.0%
2010-2020	0.4%	1.2%	0.7%	1.7%	0.7%	1.7%
2020-2030	0.2%	1.0%	0.5%	1.2%	0.5%	1.2%
2000-2030	0.4%	1.2%	0.6%	1.6%	0.6%	1.6%

Source: BST Associates, DRI-WEFA

Liquid Chemicals and Fertilizers

Receipts of liquid chemical and fertilizer products are expected to increase at average annual rates of between 0.2% and 0.8% during the course of the study period. Coastwise shipments are expected to remain at low volumes throughout the study period, reaching 25,500 (low) to 37,200 tons (high) in 2030.

Table 60 – Lower Columbia River Liquid Chemical and Fertilizer Forecasts (1,000s of tons)

	Coastwise Receipts		Imports		Total		Coastwise Shipments	
Year	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
1990 Actual	348		101		449		132	
2000 Actual	99		185		284		31	
Forecast								
2010	100	108	195	200	294	309	28	38
2020	102	119	200	209	302	328	25	38
2030	104	127	204	213	308	340	25	37
Compound Annual Growth Rates								
1990-2000	-11.8%		6.3%		-4.5%		-13.6%	
2000-2010	0.1%	0.9%	0.5%	0.8%	0.4%	0.8%	-0.9%	2.0%
2010-2020	0.2%	1.0%	0.3%	0.4%	0.3%	0.6%	-1.0%	0.1%
2020-2030	0.2%	0.6%	0.2%	0.2%	0.2%	0.3%	0.0%	-0.2%
2000-2030	0.2%	0.8%	0.3%	0.5%	0.3%	0.6%	-0.6%	0.6%

Source: BST Associates, DRI-WEFA