Signed on 4/15/92 Jens G Ron G

MEMORANDUM OF UNDERSTANDING

THIS MEMORANDUM OF UNDERSTANDING is made this _____ day of _____, 1992, by and between the following agencies: **HOOD RIVER COUNTY,** hereinafter referred to as "County"; **UNITED STATES FOREST SERVICE,** hereinafter referred to as "USFS"; **STATE OF OREGON,** hereinafter referred to as "State"; and **COLUMBIA RIVER GORGE COMMISSION,** hereinafter referred to as "Commission".

PURPOSE

The purpose of this Memorandum of Understanding is to achieve an equitable, mutually-acceptable means of resolving mining and forestry uses on lands owned by Hood River County and designated Open Space by the Gorge Commission. The affected lands are located east of Hood River, and include the East Rock Pit and approximately 350 acres of Douglas-fir/ponderosa pine and Oregon oak woodland. These lands have been used for mining and timber harvesting by Hood River County. They contain significant and sensitive scenic, natural, cultural and recreation resources that could be adversely affected by continued mining and timber harvesting. The parties to this Memorandum agree to cooperate and coordinate efforts to facilitate resolution of these issues. Resolution may include land exchange, cooperative used of resources, and/or other mutually acceptable alternatives. The parties to this Memorandum are Hood River County, USDA - Forest Service, Columbia River Gorge Commission and the State of Oregon. The parties agree:

(1) To use their full faith and resources in an effort to explore a full range of alternative solutions, including land exchanges, cooperative use of resources, conservation or scenic easements, and land acquisitions.

(2) To establish working groups, consisting of qualified representatives of each of the parties, to evaluate, study, establish boundaries, develop an action plan, propose exchange alternatives and make recommendations.

(3) To set time deadlines for each of the implementation steps.

(4) To consider and agree on meeting dates and notification of the parties to review, present, argument, and reach a decision as to issues pertinent to the resolution of the issues.

(5) To define roles and responsibilities of the parties.

(6) To establish interim use guidelines, limitations on quarry expansion, mitigation options, and a schedule for reclamation to include a reclamation site plan.

(7) To establish a protocol for determining the value of the exchange lands to include the costs of future reclamation of the East County Quarry.

(8) To establish a policy of coordination and notification, between the parties, of any significant actions planned to take place on the affected County lands.

(9) To display anticipated costs of work related to this Memorandum of Understanding and agree how these costs will be shared.

(10) That other agencies or parties, who could contribute to resolution of issues, should be encouraged to participate in this effort.

ORGANIZATION

The parties have agreed that County shall be the lead agency in the coordination of this effort and that County will be in charge of scheduling coordination and notification of the parties for all future meetings.

The parties hereby establish two separate working groups to be made up of representatives of the parties to deal specifically with concerns involving resolution of the rock quarry and the

timberland. The respective working groups will be called the "Rock Group," which will deal with specifics of resolution of the East Pit, and the "Timber Group," which will deal specifically with resolution of the timberland of Hood River County in the National Scenic Area East of Hood River. The parties hereby charge the respective groups with the following responsibilities:

(1) To establish boundaries of the properties;

(2) To utilize expertise, including geo-technical experts, if required;

(3) To evaluate the County's property and potential alternative exchange properties;

(4) To consider joint quarry site operations;

(5) To explore potential alternatives for land exchanges, conservation easements, and acquisitions, both for the quarry site and the timberland.

Both working groups shall have the responsibility to organize and coordinate their activities, to set the time for meetings to carry on their required activities, to devise implementation steps, including use of expert personnel, when necessary, to evaluate and decide on selected alternatives and to make recommendations to be reported back to the parties on the specific dates hereinafter set forth.

The following key representatives are selected to make up the two working groups:

(1) <u>The Rock Group</u>:

(a) Jim Lyons, Hood River County;

(b) Mike Ash, U. S. Forest Service (USFS);

(c) Donald Adams, Oregon Department of Transportation (ODOT);

(d) Frank Schnitzer, State of Oregon Department of Geology and Mineral Industries (DOGAMI);

(e) Joyce Reinig, Columbia River Gorge Commission;

(f) Allen Bell.

(2) The Timber Group:

(a) Ken Galloway, Hood River County;

(b) Murray Johnson and Connie Pittock, U.S. Forest Service (USFS);

(c) Jack Wiles, State of Oregon;

(d) Joyce Reinig, Columbia River Gorge Commission;

(e) Allen Bell.

The above named persons or their designees shall act as the appointed members of the above two working groups and are charged with carrying out the respective working groups functions.

TIMING

The parties hereto have committed, each to the other, to use best efforts in attempting to cooperatively resolve the above defined issues. The parties agree that timing is important and each commits to dedicate its time and resources to resolve the issues as expeditiously as possible. The parties will, from time to time, set meetings for the purpose of receiving information and recommendations from the two working groups and to work towards resolving the issues. The first progress report from the working groups shall be submitted to the parties at a meeting to be held at the Hood River County Courthouse, Board of Commissioners Meeting Room, Hood, River, Oregon, at 9:30 a.m., on Wednesday, April 15, 1992. The time deadline for final draft

reports from the two working groups is set for August 3, 1992 for the Rock Group working group report, and May 1, 1992 for the Timber Group working group report. These times may be adjusted by mutual consent and based upon progress made by each of the working groups.

This Memorandum of Understanding is entered into this day and year first above written.

HOOD RIVER COUNTY,

By _____
Jerry Routson, Chairman
Board of County Commissioners

UNITED STATES FOREST SERVICE,

By _____
Arthur J. Carroll, CRGNSA

STATE OF OREGON,

By _____
Jack Wiles, Governor's Office

COLUMBIA RIVER GORGE COMMISSION,

By _____
Stafford Hansell, Chair

ROUTING AND TRANSMITTAL SLIP		ACTION
1 TO: Jerry Carey	INITIALS	CIRCULATE
	DATE	COORDINATION
2	INITIALS	FILE
	DATE	INFORMATION
3	INITIALS	NOTE AND RETURN
	DATE	PER CONVERSATION
4	INITIALS	SEE ME
	DATE	SIGNATURE

REMARKS

Inclosed is sent to you by request of GENE TORGET NPD

Do NOT use this form as a RECORD of approvals, concurrences, disapprovals, clearances, and similar actions.

FROM	DATE
KARL PROCTOR	8 Feb 78
	PHONE 221-6479

OPTIONAL FORM 41
AUGUST 1967
GSA FPMR (41CFR) 101-11.206

5041-101-01

Barge rate
$.015/ton mile
$40 to $50 from Santosh to Portland

Columbia River and Tributaries
Bonneville Lock and Dam
Oregon and Washington, #
Feasibility Study for
Modifying the Lock
Prepared by the Army Corps of Engineers, Portland District.
1/77

SECTION 9

SAND AND GRAVEL

55. Introduction. Sand and gravel are important construction materials. When mixed with cement they form concrete, which is the most commonly used construction material because of its versatility, durability, and relatively low cost. In 1973, 22.8 million tons of sand and gravel were used for public and private construction in Oregon.[1/] Of this total, 51 percent was used to pave roads and highways, and 27 percent was used in general construction, including buildings, sewers, and piers. The remaining 22 percent was used for landfill and miscellaneous purposes. Road construction (asphalt paving) accounted for 97 percent of government (public) use and 42 percent of private use. In 1973, 39,000 tons of sand and gravel, accounting for less than 1 percent of total traffic, passed through Bonneville Lock. However, projected production of sand and gravel in Portland SMSA is not expected to meet future demand. Locations of alternative sources of supply indicate significant increases in barge traffic through Bonneville Lock. The following discusses current and future supply and demand for sand and gravel in Portland SMSA.[2/] Special emphasis will be placed on supply and demand in the Portland-Vancouver metropolitan area, hereafter referred to as the Portland area, because this is where the largest users of sand and gravel are located.

56. Current Production and Sources.

a. The Portland area has had sizable sand and gravel resources. At one time, commercial quality sand and gravel deposits within a 15-mile radius of downtown Portland totaled over 500 million tons.[3/]

1/Source: Minerals Yearbook, 1973.

2/Portland SMSA includes Multnomah, Clackamas, and Washington Counties in Oregon and Clark County, Washington.

3/Sand and Gravel Resources, Metropolitan Planning Commission, Portland, Oregon, January 1964.

However, widespread urbanization over the past 60 years has limited the supply and availability of this sand and gravel. Urbanization often results in covering unexploited deposits. In addition, urban area residents sometimes pressure local authorities to restrict existing sand and gravel operations because of the hazard of trucks, noise and dust, and visual impact of the excavation. Because of the pressure by residents, zoning regulations are written that preclude establishment of new operations or expansion of existing ones. Quantity available is further limited because not all sand and gravel is of sufficient quality to meet engineering specifications. Commercial quality material is sometimes a small percentage of total resource volume. The Columbia River once supplied large quantities of sand and gravel to the Portland area. Hydroelectric dams on the river have deepened the water, reduced passage of new gravel, and thus eliminated many supply sources.[1/]

b. Sand and gravel supplied to the Portland area comes from open pit mines, quarries, and dredging operations. The major supply source is a dredging operation in the Willamette River at Ross Island. Another important source is a pit mine at Scappoose, Oregon, where sand and gravel is mined, processed, and delivered to barges by a 1-mile-long conveyor system. The material is then barged to the Portland area. In 1971, the maximum quantity of sand and gravel available in these deposits was estimated at 165 million tons. Table 9.1 summarizes sand and gravel usage in Portland SMSA from 1950 through 1974. Also shown are population figures and tons per capita ratios which illustrate the historical relationship between population and usage of sand and gravel in Portland SMSA. Per capita use of sand and gravel has varied from 3.1 tons (1963) to 8.3 tons (1972) and has averaged 5.3 tons over the 25-year period. The Bureau of Mines estimates that per capita use of sand and gravel is about 9 tons for Oregon. The variations in per capita usage reflect the large quantities used for dam and road construction in less populated areas.

1/Lower Willamette River Basin, State Water Resources Board, Salem, Oregon, June 1965.

c. As sources of sand and gravel in the metropolitan area become depleted, additional sources much farther away from Portland will be developed. However, transportation costs impose an economic limitation on resource locations. Because sand and gravel have a low value relative to weight, it is sensitive to transportation costs. Maximum economical trucking distance from deposit to construction site has been estimated at ~~20~~ 48 miles.[1/] Average sand and gravel costs per ton, including trucking costs, are said to double every 10 miles from the supply source.[2/] As sources of sand and gravel in the metropolitan area become exhausted, barge transportation from distant deposits will play an important role in the economics of the sand and gravel industry.

57. Projected Demand for Sand and Gravel. Projected demand for sand and gravel was estimated by multiplying per capita usage times projected population in Portland SMSA. Per capita usage averaged 5.3 tons from 1950 through 1974. However, this ratio increased from an average of 5.0 (1950-1960) to 7.1 (1970-1974) and reached a peak of 8.3 in 1972. This increase was taken into account by projecting demand based on a per capita usage of 7.0 tons, which was assumed constant over the project life. Projected population in Portland SMSA was taken from OBERS Series E Projections, Volume 5, 1972.[3/] Projected annual demand for sand and gravel is shown in table 9.2.

1/Sand and Gravel Industry in Oregon, Herbert G. Schlicker, Oregon State Department of Geology and Mineral Industries.

2/Oregon Concrete Aggregate Producers Assoc. (OCAPA), Portland, Oregon.

3/OBERS projections are prepared jointly by Bureau of Economic Analysis (BEA), U.S. Department of Commerce and the Economic Research Service (ERS), U.S. Department of Agriculture with assistance from the Forest Service. BEA was called Office of Business Economics (OBE) prior to 1972.

TABLE 9.1

HISTORIC SAND AND GRAVEL USAGE
PORTLAND SMSA

Year	Population 1/	Short Tons 2/	Tons per Capita
1950	709,458	2,970,500	4.2
1951	718,000	3,345,300	4.7
1952	730,000	3,136,900	4.3
1953	741,000	3,328,600	4.5
1954	752,000	4,149,100	5.5
1955	762,000	3,595,600	4.7
1956	773,000	4,410,600	5.7
1957	785,000	4,332,300	5.5
1958	796,000	3,656,300	4.6
1959	808,000	4,641,100	5.7
1960	819,000	4,801,800	5.9
1961	831,000	3,714,000	4.5
1962	843,165	3,200,000	3.8
1963	863,000	2,696,000	3.1
1964	994,000	3,806,000	4.3
1965	906,000	5,411,000	6.0
1966	927,000	3,481,000	3.8
1967	950,000	4,297,000	4.5
1968	973,000	6,094,000	6.3
1969	996,157	6,043,000	6.1
1970	1,013,780	7,435,000	7.3
1971	1,033,169	7,556,000	7.3
1972	1,045,000	8,669,000	8.3
1973	1,057,000	7,596,000	7.2
1974	1,094,000	6,064,000	5.5

Tons per capita ratios:

1950-1960	1960-1970	1970-1974	1950-1974
5.0	5.1	7.1	5.3

1/OBERS Series E (Volume 5, 1972) data for 1950, 1962, 1969, 1970 and 1971. Data for all other years are rounded estimates.

2/U.S. Department of Interior, Bureau of Mines, Division of Nonmetallic Minerals, Washington, D.C. Personal telephone communication, 1976.

TABLE 9.2

PROJECTED DEMAND FOR SAND AND GRAVEL
PORTLAND SMSA

Year	Portland SMSA Population 1/	Tons per Capita	Total Annual Demand 3/
1980	1,147,000	7.0	8,000,000
1985	1,215,000	7.0	8,500,000
1990	1,288,000	7.0	9,000,000
2000	1,391,000	7.0	9,700,000
2020	1,566,000	7.0	11,000,000
2040	1,762,000 2/	7.0	12,300,000

1/OBERS Series E, Volume 5, 1972. Numbers rounded to nearest 1,000.

2/Based on annual growth rate from 2000 to 2020 of 0.39 percent.

3/Projected values rounded to nearest 100,000 tons.

Figure 9-1 shows accumulated demand for sand and gravel. For example, accumulated demand in 1990 is the sum of annual sand and gravel production (demand) in years 1971 through 1990. Figure 9-1 also shows the estimated 165 million tons of sand and gravel reserves in Portland SMSA will be depleted by 1991. Continuing urbanization of rural areas also depletes effective reserves. Not including the effect of urbanization results in a conservative projection of demand. Unless there is adequate zoning to protect the reserves from urbanization or unless additional sources are found, available supply in the Portland area will probably be exhausted before 1991. The following sections discuss alternative sources of sand and gravel reserves and the costs of transporting the sand and gravel to the Portland area.

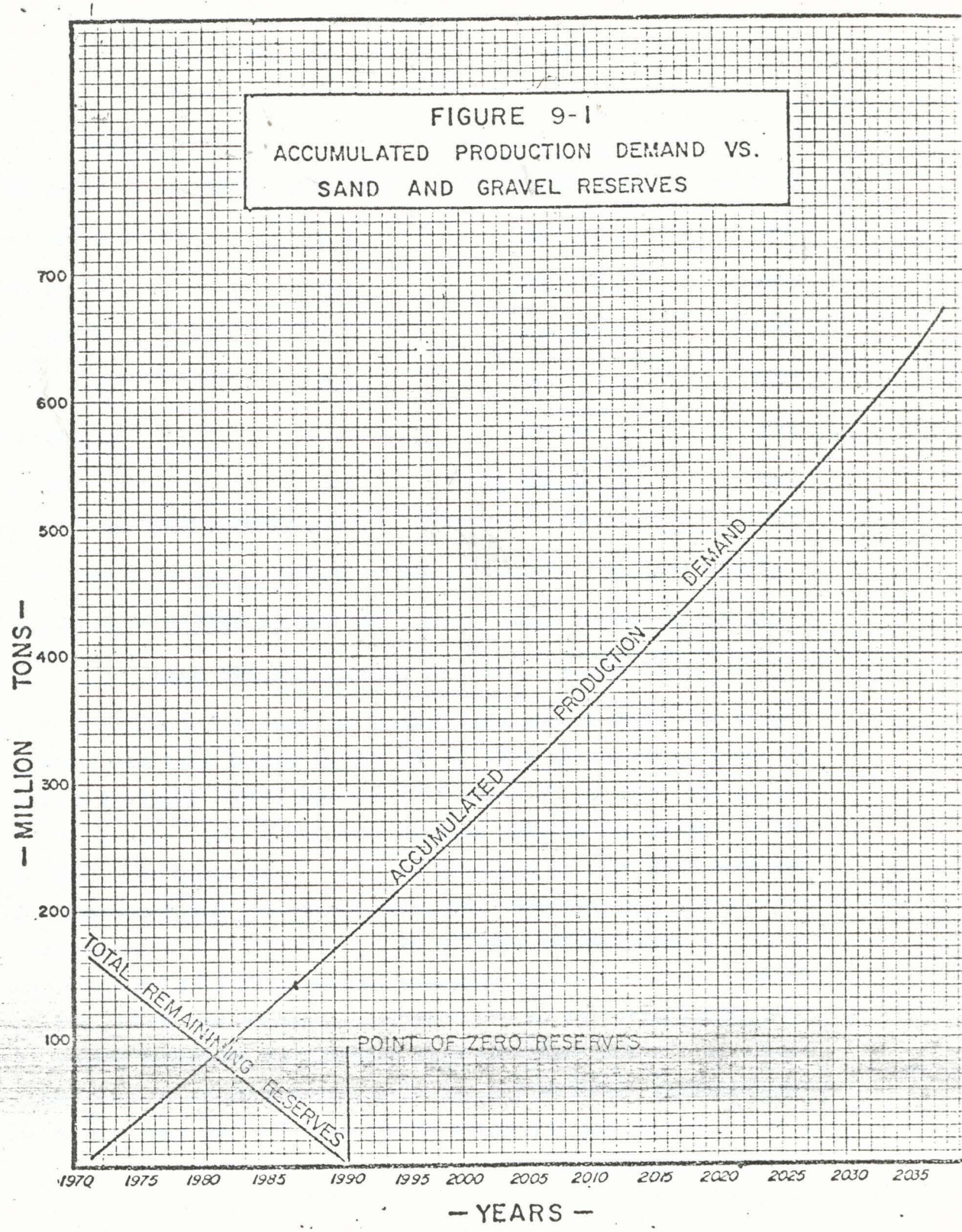
FIGURE 9-1
ACCUMULATED PRODUCTION DEMAND VS.
SAND AND GRAVEL RESERVES
700
600
500
400
300
200
100
— MILLION TONS —
ACCUMULATED PRODUCTION DEMAND
TOTAL REMAINING RESERVES
POINT OF ZERO RESERVES
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
— YEARS —

58. Future Sand and Gravel Sources. Four assumptions were made in analyzing future sources of sand and gravel: (a) there would be no new substitutes for concrete aggregate; (b) there would be no new process affecting the amount of sand and gravel used to make concrete; (c) existing urban areas would not be removed to expose sand and gravel deposits; and (d) quarry rock would not be used extensively for sand and gravel. Many of the future sources are still undeveloped. Therefore, the costs of moving sand and gravel from these sources to the Portland area were estimated using the best information available. Determination of primary future sources of sand and gravel for the Portland area was based on comparison of various sources with respect to quality, quantity, delivered cost by various transportation modes, and on environmental acceptability. The following summarizes each major supply area.

Not True

59. Lower Willamette River. The lower Willamette River is presently the major source of sand and gravel for Portland. Eighty percent of Portland's sand and gravel is produced by three companies that dredge the material from the lower Willamette River. One company also operates a pit mine at Scappoose, Oregon. The pit mine at Scappoose is projected to supply about 2 million tons per year to the year 2000 at which time known reserves will be exhausted. The lower Willamette River will not be a major source of aggregate in the future. Based on a trend line of recent production rates, reserves in the lower Willamette will be thoroughly depleted by 1991 and probably sooner. Environmental interests are also currently trying to stop or restrict the Ross Island operation in the lower Willamette River. Whether caused by environmental legislation or resource depletion, officials of the aggregate industry believe the lower Willamette River will not be a source of sand and gravel beyond 1985. Therefore, sand and gravel necessary to meet projected demand after 1985 must come from other sources.

60. Upper Willamette River.

a. The upper Willamette River, which extends from the Oregon City Locks (RM 27) to Eugene (RM 185), contains substantial quantities of sand and gravel. Deposits between the locks and Wilsonville (RM 39) are located mainly at the New Era Bar (RM 31-34). Most of these deposits are in the riverbed because the stretch of the upper Willamette from RM 27 to 50 has maintained the same course over time. Deposits from RM 39 to 49 are shallow and spotty, and not likely to be dredged. From Newberg (RM 50) to Eugene, the river has meandered over time. Consequently, sand and gravel deposits are found both in the river and on the land adjacent to the river. Above RM 56, the river is too shallow (3 to 4 feet) for barge navigation. Sand and gravel operations above RM 56 would require dredging a channel deep enough for tug and barge equipment. Therefore, barge movements of sand and gravel from the upper Willamette River were limited to RM 56.

Not True

b. Only one company dredges sand and gravel from the upper Willamette River. The company's practice is first to supply local area demand for sand and gravel. Material is barged to their processing plant in Wilsonville, processed and trucked to local markets including Wilsonville, McMinnville, Newberg, Forest Grove, Hillsboro, Beaverton, and Oregon City. After supplying local needs (about 200,000 tons per year), the company barges sand and gravel to Portland. Barge shipments have historically averaged about 400,000 tons annually. Most of the company's dredging occurs in the river at the New Era Bar. Based on current usage, these deposits are not expected to last beyond 1978. After 1978, dredging will probably occur outside Portland SMSA in the vicinity of Newberg (RM 50). Although sizes of deposits from RM 50 to RM 56 have not been firmly established, the area is believed to contain very large quantities of sand and gravel. When deposits at New Era Bar are depleted, the company now dredging there has plans to relocate to the Newberg area. Proposed plans include a 500,000-ton per year processing plant at Newberg and a berthing area for barges at Dundee (RM 51.5). About two-thirds of the

sand and gravel to be processed at the proposed plant (335,000 tons) would be trucked to areas in Portland SMSA such as Wilsonville, Forest Grove and Hillsboro. The remaining one-third would supply areas outside Portland SMSA. Resource supply between RM 50 and RM 56 is thought to be sufficient to supply the new plant, but obtaining zone changes and approval from the Greenway Commission is an uncertainty. However, because of diminishing resources in Portland and vicinity, approval and construction of the plant was assumed for projection purposes.

c. All sand and gravel barged from sites on the upper Willamette River must pass through the Oregon City Locks, near Willamette Falls. River and land deposits south of Oregon City are currently dredged and barged through the locks to Portland at the rate of about 400,000 tons per year. However, the locks at Oregon City limit the size of barge payload to 750 tons per barge. Extensive reconstruction of the locks would be needed to accommodate larger barges and make upstream deposits economical. As sources of aggregate in the metropolitan area become exhausted, thus causing greater hauling distances, small barge loads through the locks may become economical. The cost of barge transportation from upstream deposits to Portland imposes an economic limitation on resource locations. On the other hand, the Oregon City Locks impose a physical limitation on the volume of sand and gravel that can move by barge from the upper Willamette River. Therefore, a capacity analysis was used to determine the maximum additional sand and gravel tonnage that could be barged through the existing Oregon City Locks to Portland.

d. Table 9.3 summarizes typical daily usage of the Oregon City Locks. The analysis of unused lock capacity assumed each barge or tow required an average of 2.25 hours to round trip the lock. The locks contain five chambers which would make it possible to "string" barges and tow-boats through the lock in one direction, thus increasing lock capacity. Filling all locks requires other users, principally the paper industry, to wait long periods before the entire system is cleared. This procedure

would also require more barges and towboats than current practice. "Stringing" would result in long queues on both sides of the locks and would further increase barging costs. This procedure has not been tried at the Oregon City Locks, but according to industry officials, stringing is neither economically nor operationally feasible.

TABLE 9.3

USAGE OF OREGON CITY LOCKS

User	Hours Per Round Trip (2)	Round Trips Per Day (3)	Hours Per Day Lock In Use (2) x (3)	Occurrence
Paper Industry	2.25[1/]	3	6.75	5 days/week
Sand and Gravel	2.25[1/]	3	6.75	5 days/week
Rafted logs	6.00	N/A	2.60[2/]	7 days/week
Pleasure Craft	N/A	N/A	0	Weekends
Total obligated time			16.10 hours	
Total available time			24.00 hours	
Total unused time			7.90 hours	

1/90 minutes downriver to Portland (full barge) + 45 minutes upriver (empty) = 135 minutes ÷ 60 = 2.25 hours.

2/6 hours per trip x 3 trips/week = 18 hours per week = $\frac{18}{7}$ = 2.57 hours per day (rounded to 2.60).

e. Table 9.3 shows the lock is unused 7.9 hours per day. Assuming all other uses remain constant, the locks could accommodate an absolute maximum of 3.51 additional barges per day (7.90 hours - 2.25 hours per barge). The only company that barges sand and gravel through the locks to Portland cannot barge aggregate 3 months a year because of poor river conditions. The company operates 195 days

during the remaining 9 months. Based on a 750-ton capacity barge, the Oregon City locks can accommodate an additional 513,300 tons of sand and gravel per year. (3.51 barges per day x 750 tons per barge x 195 days per year = 513,300 tons per year.) Added to the 400,000 tons that are presently barged through the locks every year, total lock capacity, using rounded numbers, was estimated at 900,000 tons per year.

f. For projection purposes, sand and gravel supplied to Portland SMSA from the upper Willamette River was estimated at 1.2 million tons per year. This includes .9 million tons barged from Dundee to Portland, and .3 million tons trucked from Dundee or Newberg to Wilsonville, Forest Grove, Hillsboro and other small markets within Portland SMSA. This tonnage will probably continue to be supplied by the company that currently dredges and barges sand and gravel on the upper Willamette. The large initial investment in dredges, barges and tugboats, plus the uncertainty of environmental legislation, fairly well limits the entry of competition to the company's operation. Barge and tugboat costs from Dundee to Portland were estimated at $1.30 per ton. As discussed later, this cost compares favorably with barge costs from other sources - particularly the upper Columbia River. Therefore, the assumption that barge movements of sand and gravel from the upper Willamette River to Portland will continue is a reasonable one.

7. Land Deposits - Upper Willamette.

a. As previously stated, numerous land deposits of sand and gravel are located throughout the Willamette Valley above Newberg. These deposits could be developed provided development and transportation costs are less than those of alternative sources and assuming no restrictions by the Greenway Plan. These sources have not been developed to supply markets in Portland because material is currently

available from closer sources at less cost. One company owns about 440 acres adjacent to the Willamette River at RM 65. The company operates an asphalt plant located between Beaverton and Hillsboro and has long-range plans to supply the plant from this source. Aggregate is currently supplied to the asphalt plant by crushing quarry rock. However, aggregate from quarry sources is more expensive to produce than that from natural gravel deposits (about double according to a 1964 Metropolitan Planning Commission estimate). Therefore, the company plans to construct a 50,000- to 100,000-tons per year processing plant near RM 65 and truck aggregate 36 miles to their asphalt plant.

b. For evaluation purposes, these land deposits were assumed to be a source of supply of sand and gravel for the Portland area. The material would have to be trucked or railed to Portland because channel depths beyond RM 56 are too shallow for barges. The 440-acre site is 10 miles from Interstate Highway 5 and about 44 miles from Portland. The nearest rail is about 8.5 miles from the site. If rail is used to transport the material, trucks would have to haul the aggregate between the processing plant and the rail line or a rail spur line would have to be built. Table 9.4 shows the estimated transportation costs of moving material from this site at RM 65 to Portland by truck, by rail and by a combination of truck and rail shipments. Cost figures do not consider the lack of rail handling or track facilities in Portland. Sand and gravel is currently transported by truck or barge.

c. Sand and gravel could move from RM 65 to the Portland area at an estimated cost of $3.52 per ton by truck or $3.65 per ton by truck-rail. As discussed later, neither of these costs compares favorably with transportation costs from sources on the Columbia River above Bonneville. If sufficiently large quantities of material were

to move from deposits near RM 65, a unit-train rate could be used in determining transportation costs. Assuming unit-train rates are 50 percent less than regular rail rates, the truck-rail cost would decrease to $2.19 per ton ($.68 plus $.05 plus $1.46 = $2.19). This cost is still not competitive with barge costs from either the upper Willamette or upper Columbia. However, 100,000 tons of sand and gravel from RM 65 could be trucked each year to the asphalt plant, which is in Portland SMSA. Therefore, total sand and gravel supplied to Portland SMSA from river and land deposits on the upper Willamette River was projected at 1.3 million tons per year, 1.2 million tons from river deposits and .1 million tons from land deposits.

TABLE 9.4

COMPARISON OF TRANSPORTATION COSTS
FROM LAND DEPOSITS AT RM 65 TO PORTLAND

Transportation Mode	Cost per Ton
Truck	
From site to asphalt plant by truck[1/]	$2.88
From site to Portland via I-5 by truck[2/]	3.52
Rail	
Cost of rail spur line[3/]	$1.35
Rail rate from site to Portland[4/]	2.92
Total Cost Per Ton by Rail	$4.27
Truck-Rail	
Truck from site to existing rail line[5/]	$ .68
Extra loading costs[6/]	.05
Rail rate[4/]	2.92
Total Cost Per Ton by Truck-Rail	$3.65

1/Trucking costs from site to plant (and Portland) were estimated at $0.08 per ton-mile based on conversations with K-line Trucking Company. ($0.08) x (36 miles) = $2.88

2/($0.08) x (44 miles) = $3.52

3/Burlington Northern estimated spur line cost as follows:

a.	Construction cost-($30/foot)x(5,280 ft/mile)x(8.5 miles) =	$1,346,400
b.	Land cost - ($5,000/acre)x(30.9 acres) = (8.5 miles long)x(5,280 ft/mile)x(30 ft wide = 30.9 acres	155,000
c.	Initial investment cost =	$1,501,400
d.	Interest and amortization on initial investment - (20 year economic life at 6-3/8 percent) =	$134,900
e.	Annual maintenance =	0
f.	Total annual cost =	$134,900

$134,900 ÷ 100,000 tons = $1.35 per ton

4/Rail rate was based on single-car rate of $2.92 per ton from Salem to Portland. An estimated unit-train rate was not used due to small tonnages.

5/($0.08 per ton mile)x(8.5 miles) = $0.68.

6/Loading material on trucks and again on rail cars entails one additional loading cost. This assumes the use of a hopper. Estimated cost of a hopper is $40,000 or $3,600 per year at 6-3/8 percent for 20 years. Maintenance costs were estimated at $1,000 per year. Total annual costs are $4,600. Cost per ton is $4,600 - 100,000 tons per year or $0.05 per ton. The truck driver was assumed to operate the hopper.

62. Clackamas River.

a. The Clackamas River is about 70 miles long and empties into the Willamette River about 10 miles south of Portland. The river has large quantities of sand and gravel which are replenished with each freshet. Three sand and gravel pit operations are located near the Clackamas River: one near Carver, one 5 miles east of Carver, and one near Estacada. The three plants produce about one million tons annually. At current extraction rates, sand and gravel deposits for the two plants near Carver were estimated to last until 1995. Deposits for the Estacada plant were estimated to last until 2015. The plant near Carver is about 12 miles from Portland and provides material to the Portland area. The other two plants serve only local area needs and plant owners say this practice will continue. All three plants deliver sand and gravel by truck. Trucking costs to Portland vary from $1.30 to $2.20 per ton, which are relatively high. Barge transportation is not possible on the Clackamas River because of inadequate river depths.

b. Environmental considerations also show the Clackamas area will not be a major sand and gravel producer. Clackamas Planning Department officials indicated efforts to expand sand and gravel operations in the area would meet heavy local opposition. General policy described in the Clackamas County Comprehensive Plan is to preserve the natural assets of the river and not allow commercial or industrial development within 1,000 feet of the river. Industry officials conclude that additional sand and gravel operations will not be permitted on or near the Clackamas River for environmental reasons. Sand and gravel production of the three existing plants, which are located in Portland SMSA, were included in the miscellaneous category. Additional sand and gravel operations of significant size were not projected because of high transportation costs and environmental constraints.

63. Clark County, Washington. Portland SMSA includes Clark County, Washington. Population of Clark County in 1970 was 128,000 which was the smallest of the four counties in the SMSA. Several sand and gravel deposits supply the needs of Clark County. These deposits may become more important as Portland's immediate source of aggregate is depleted and when the Interstate 205 bridge across the Columbia River is completed in 1981 or 1982. This bridge, expected to be open in 1978, will make some deposits in Clark County immediately accessible to East Portland. The five largest sand and gravel producers in Clark County have combined deposits of about 70 million tons. If these deposits are depleted evenly throughout the period 1975 to 2040, about 1.1 tons per year will be supplied from Clark County. This level of production was assumed in forecasting supply from Portland SMSA.

64. Miscellaneous Sources. In addition to the major sources previously described, there are small pit mines and quarries supplying material in each county in Portland SMSA. These and other similar operations will probably continue throughout the study period. For projection purposes, these sources were assumed to supply 10 percent of the sand and gravel needed to meet Portland SMSA demand.

65. Columbia River. The Columbia River extends 1,207 miles from Canada to its mouth at Astoria, Oregon, on the Pacific Ocean.. Prior to 1930, the Columbia River did not have dams which now slow its current. According to geologists, the fast flowing river produced millions of tons of sand and gravel which were deposited in the riverbed and adjacent lands. Exact location and quantity of sand and gravel deposits have not, for the most part, been identified because there has been little demand for the resource. Portland, the only large metropolitan area near the Columbia River, currently obtains its aggregate supply from the Willamette River and immediate area. As these supplies are depleted, the Columbia River is expected to become a major source of sand and gravel. Only deposits above Bonneville Dam are of aggregate quality. Deposits below the dam contain large amounts of pumice and are not suitable for concrete or asphalt production. The material does contain a fine grade of masonry sand useful in making plaster and landscaping gardens.

66. The Dalles Area. There are two aggregate producers in The Dalles area. The producer located at Dallesport (RM 188.5) is relatively small with reserves estimated at 6 million tons. This plant supplies only local needs and is expected to continue doing so. The other plant is located at Avery, Washington, about 6 miles above The Dalles Dam. The 100-acre site at Avery has deposits over 300 feet deep which contain an estimated 70 million tons of sand and gravel. In analyzing transportation costs from Avery to Portland, it was assumed the deposits would be extracted evenly over the 50-year period, or 1.4 million tons annually.

67. Transportation Costs - Avery to Portland. The small processing plant at Avery currently produces 20,000 to 30,000 tons of sand and gravel per year. The plant is located between two rail lines and about 100 feet from the Columbia River. Both lines are used for other traffic and could not be used to store rail cars while they were being filled. A spur line would have to be built for the plant to accommodate rail shipments on a regular basis. Since there is not enough vacant land adjacent to the processing plant to build a spur line, the plant would have to be relocated. However, a new plant would be required anyway if production were to increase to 1.4 million tons annually, regardless of the mode of shipment from Avery to Portland. Therefore, rail transportation costs were based only on the cost of a new spur line plus the rail rate to Portland. Transporting 1.4 million tons of sand and gravel annually would require 77 fifty-ton cars, 365 days per year. Seventy-seven cars would require 8,500 feet of spur track which would cost about $250,000. Amortized over 50 years at 6-3/8 percent interest, average annual equivalent cost of the spur line is $16,700, or $.012 per ton. Because of the volume of sand and gravel involved, unit-train shipments would be feasible. The unit-train rate was estimated at $2.90, or one-half the regular one-car rate of $5.80 from Avery to Portland. If the sand and gravel were shipped by barge, 1.5 barges per day would be necessary. Building a new processing plant would require new pilings and dolphins to accommodate the barges. However, the average annual equivalent cost of dolphins per ton of sand and gravel of $0.001 is negligible. A conveyor extending from the existing

plant to the water could be used with a new plant. Barge transportation costs from Avery to Portland were estimated at $1.35 per ton. Rail costs and barge costs are summarized in table 9.5.

TABLE 9.5

COMPARISON OF RAIL COSTS AND BARGE COSTS
AVERY TO PORTLAND

Mode of Shipment	Cost per Ton
Barge	
Barge Tariff	$1.35
Rail	
Rail Rate	$2.90
Spur Line	.01
Total	$2.91
Difference in Transportation Costs	$1.56

68. Boardman Area.

a. The only processing plant currently operating in the Boardman area generally serves local needs from reserves estimated at 2.9 million tons. This facility was assumed to continue serving the local area. The Boardman area has other large deposits of high quality sand and gravel that could be developed with sufficient demand. Four of these deposits alone are estimated to contain over one billion tons of sand and gravel. These reserves would provide about 20 million tons per year if dredged to exhaustion in 50 years. The following describes each of these deposits:

b. A 250-acre bar about 2 miles east of Irrigon, Oregon near river mile 283. The deposit is estimated to be 22 feet deep amd capable of providing about 13 million tons of material.

c. A 250-acre bar about 10 miles west of Irrigon, Oregon, near Blalock Island and river mile 270. The deposit is estimated at 13 million tons.

d. Blalock Island and adjacent gravel bar. This area is 7.5 miles long, 3 miles wide, and is located 3 miles east of Boardman near river mile 272. The area is almost entirely sand and gravel except for cover material and a 1/2-mile section at the end of the island. Tests show the material is between 21 and 40 feet deep. This would provide about 980 million tons if the material averages 30-feet deep.

e. Coyote Island. This island is one-mile long, 1/2-mile wide, and is located between Blalock Island and the Oregon shoreline. Resources are about 21 feet deep and are estimated at 16 million tons.

69. Transportation Costs - Boardman to Portland.

a. Barge rates and rail rates were determined from a single, permanent, land-based processing plant at Boardman to Portland. A combination floating dredge and processing facility was considered but ruled out because of environmental considerations. A floating facility would deposit processed material directly into barges for shipment to Portland. If rail shipments were used with a floating facility, rail rates would be higher than shown below. The added costs would come from barging the material to a dock, unloading it, and reloading it on rail cars.

b. For analytical purposes, the Boardman area was projected to supply that portion of sand and gravel demand in Portland not met from The Dalles or other previously discussed sources. In practice, some material may come from the Umatilla area, about 20 miles upriver from Boardman. However, deposits at Boardman are large enough that Umatilla can be considered a secondary source. Barge costs from Boardman to Portland were estimated at $1.75 per ton and rail costs at $3.50 per ton. Rail costs approximate a unit-train rate and were

based on 50 percent of the single car rate of $7.00 per ton. Transportation cost savings from barge shipments are, therefore, $1.75 per ton, assuming all other handling and storage costs are equal for both rail and barge.[1/]

70. Analysis of Delivered Cost. The following analysis compares the total cost of delivering aggregate to Portland from the upper Willamette River (tables 9.6 and 9.7) and from the Boardman area (table 9.8). Two methods are presented for Boardman. One method shows delivered costs using a combined floating dredge and processing facility. The second shows delivered cost with a stationary land-based processing plant. Costs of each method approximate industry costs for similar operations in the Portland area. The difference in delivery costs between the upper Willamette land deposits ($6.27) and mid-Columbia ($4.79) is $1.48 per ton. This amount would have been used to determine unit savings if sand and gravel operations could be developed in the upper Willamette. However, these operations must compete with alternative uses. The Willamette Valley between Portland and Salem is being used increasingly for residential and industrial expansion. A few small operations may find it possible or feasible to open a 50,000 to 100,000 ton operation similar to those described in the text. Most importantly, sand and gravel deposits on the upper Willamette are either too small or too costly to utilize to be practicable sources of supply for the Portland area.

1/The future importance of Boardman and Umatilla County sand and gravel resources to the Portland SMSA is further documented by a State of Oregon, Department of Geology and Mineral Resources draft report. That report, by H.G. Schlicker et al, Aggregate Resources of Umatilla County, Oregon, Department of Geology, Portland, Oregon, 1976, surveys Umatilla County sand and gravel supplies. It notes locations and compares the importance of low cost (barge) transportation. It also projects export of about 5 million tons annually of these supplies beginning about 1980.

71. Summary of Transportation Savings. Table 9.9 summarizes sources of sand and gravel projected to supply Portland SMSA demand from 1990 to 2040. Table 9.10 summarizes average annual transportation savings of $10,550,000 for sand and gravel barge shipments versus rail shipments discounted over the period 1990 to 2040 by 6-3/8 percent interest.

TABLE 9.6

ANALYSIS OF DELIVERED COST
UPPER WILLAMETTE RIVER (DUNDEE) - PORTLAND

Operation	Cost Per Ton
Dredging Cost	$0.40
Barging Cost	0.30
Tugboat Cost	1.00
Unloading Cost	0.10
Processing Cost	1.25
	$3.05
Administration and Profit (40%)	1.22
Selling Cost - Portland	$4.27

TABLE 9.7

ANALYSIS OF DELIVERED COST
LAND DEPOSITS - UPPER WILLAMETTE RIVER - PORTLAND

Operation	Cost Per Ton
Mining Costs	$0.35
Trucking Costs	2.88
Processing Costs	1.25
Administration and Profits (40%)	1.79
Selling Cost - Portland	$6.27

TABLE 9.8

ANALYSIS OF DELIVERED COST
BOARDMAN TO PORTLAND

Operation	Cost Per Ton
METHOD ONE - Floating Dredge and Processing Facility	
Dredging Cost	$0.26
Processing Cost	1.00
Barge Cost	1.75
Unloading Cost (Portland)	0.10
	$3.11
Administration and Profit (40%)	1.24
Selling Cost - Portland	$4.35
METHOD TWO - Land-Based Processing Plant	
Dredging Cost	$0.26
Barge Cost to Plant	0.06
Unloading Cost	0.10
Processing Costs	1.00
Reloading Cost (to Barge)	0.15
Barge Costs	1.75
Unloading Costs (Portland)	0.10
	$3.42
Administration and Profit (40%)	1.37
Selling Cost - Portland	$4.79

TABLE 9.9
PROJECTED SUPPLY AND DEMAND FOR SAND AND GRAVEL IN PORTLAND SMSA

Year	Portland SMSA Population 1/	Tons per Capita	Total Annual Demand	Lower Willamette and Scappoose	Upper Willamette	Clackamas County	Clark County	The Dalles (Avery)	Columbia River (Boardman)	Misc.2/	Total Annual Supply
	(2)	(3)	(2)x(3)	(millions of short tons)							
1980	1,147,000	7.0	8,000,000	5.5	.7	1.0	0.0	0.0	0.0	..8	8,000,000
1985	1,215,000	7.0	8,500,000	2.0	.9	1.0	1.1	1.4	1.3	.8	8,500,000
1990	1,288,000	7.0	9,000,000	2.0	1.3	1.0	1.1	1.4	1.3	.9	9,000,000
2000	1,391,000	7.0	9,700,000	0.0	1.3	0.0	1.1	1.4	4.9	1.0	9,700,000
2010	1,486,000	7.0	10,400,000	0.0	1.3	0.0	1.1	1.4	5.6	1.0	10,400,000
2020	1,566,000	7.0	11,000,000	0.0	1.3	0.0	1.1	1.4	6.1	1.1	11,000,000
2030	1,670,000	7.0	11,700,000	0.0	1.3	0.0	1.1	1.4	6.7	1.2	11,700,000
2040	1,762,000	7.0	12,300,000	0.0	1.3	0.0	1.1	1.4	7.3	1.2	12,300,000

1/OBERS, Series E, Volume 5, 1972.
2/Estimated at 10 percent of total annual demand.

TABLE 9.10

SUMMARY OF TRANSPORTATION SAVINGS
COLUMBIA RIVER 1990-2040

Year	Source		Total
	The Dalles ($1.56)	Boardman ($1.75)	
1990	$2,180,000	$2,280,000	$4,460,000
2000	2,180,000	8,580,000	10,760,000
2010	2,180,000	9,800,000	11,980,000
2020	2,180,000	10,680,000	12,860,000
2030	2,180,000	11,730,000	13,910,000
2040	2,180,000	12,780,000	14,960,000

Average Annual Benefits = $10,550,000
(6-3/8% interest)