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Westbrook Arterial, Westbrook - Portland, Maine; Draft Environmental Impact Statement

Edwards and Kelcey

FHWA-ME EIS-74-01-D

WESTBROOK ARTERIAL
WESTBROOK - PORTLAND, MAINE

DRAFT ENVIRONMENTAL IMPACT STATEMENT

MAINE
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

EDWARDS AND KELCEY, CONSULTANTS

FHWA-ME-EIS-74-01-D

ADMINISTRATIVE ACTION FOR

2.8 to 3.5-mile construction of Westbrook Arterial
Westbrook-Portland, Cumberland County, Maine
U-012-1(4)

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

and

MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

Submitted pursuant to 42 U.S.C. 4332(2)(C) and 23 U.S.C. 128(a)

prepared by

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October 15, 1974

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(1) Federal Highway Administration
Administrative Action - Environmental Statement

(X) Draft ( ) Final
( ) Section 4(f) Statement attached

(2) For additional information concerning the proposed action and environmental statement, contact:

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(3) Description of Proposed Action

The proposed action consists of the construction of the Westbrook Arterial from its present terminus at the Westbrook Connector in the city of Westbrook easterly to Sewall Street in the city of Portland where the Arterial will connect to an interchange with Interstate 295. The project will be on new location for 2.8 to 3.5 miles, depending on which alternate is selected. The Arterial will provide a four-lane divided highway with full control of access.

There are several reasons why the Arterial is important to area transportation: improvement of traffic service and reduction in accident rates in the Brighton Avenue corridor; the economic viability of downtown Portland; improvement in land development potential; and recognition of commitments and committed development in anticipation of construction of the Arterial.

A major reason for the justification of the Westbrook Arterial is the necessity to provide a highway facility which would serve the expected future traffic demands in the Brighton Avenue corridor. The Portland Area Comprehensive Transportation Study (1965, updated 1970) identified the need for a highway improvement in the corridor. The two east-west roadways, Brighton Avenue and Westbrook Street are now deficient and will be significantly more deficient in traffic capacity by 1994.

The Arterial should significantly improve the overall traffic accident rates for the Brighton Avenue corridor. The proposed controlled access facility and its accompanying high design standards minimize conflicts with other traffic and the number of required decisions on the part of motorists.

Adequate highway access between downtown Portland and all neighboring communities is a necessary factor in the revitalization of "in-town" Portland, a better than $60 million task which is currently underway and for which east-west

mobility is extremely important, if not vital. At present, highway access to the Portland Peninsula from the north and south is provided by Interstate 95 and U.S. Route 1, while no major arterial highway is available for travel between the Peninsula and downtown Portland and Westbrook-Gorham and the more westerly areas of the State.

Another economic benefit which could be realized is the increased development opportunity for the open land in both Westbrook and Portland adjacent to the Arterial. Some of this development has already taken place in the two communities.

One of the strongest elements supporting the necessity for and completion of the Westbrook Arterial is the large, existing commitment of private and public capital based on agreements made in the 1960's between the communities involved and the State. Although not documented, it is felt that many additional, perhaps lesser, private decisions related to investment or deferral of investment have hinged on the earlier commitments made regarding the existence and basic configuration of the Arterial facility. It is reasonable to presume that other decisions await resolution of the details of configuration, given the premise of the existence of the basic facility.

(4) Environmental Effects of the Proposed Action

Fulfillment of the project objectives as described above in section (3) will result in significant, beneficial social and economic impacts on a regional basis. No significant, adverse regional impacts are foreseen; however, a reduction in acreage of productive wetlands in the Fore River will result, thereby eliminating a portion of the Casco Bay food web. At the present time it is not possible to evaluate the regional significance of this adverse impact on Casco Bay. The problem is further compounded by the fact that there are approximately 916 total acres of tidal wetlands which may make a contribution to the Bay's food web on a regional basis.

On a community basis, the Westbrook Arterial has the potential to stimulate considerable economic growth for the city of Portland. Since the proposal is basically in conformity with land use policy and planning, no significant, unforeseen development is anticipated. The project will likely bring about pressure to rezone certain tracts of land in the study area since the location of an interchange at Congress Street and the limited access feature of the highway will tend to make certain areas highly desirable for commercial or industrial activities.

Increased residential development is also anticipated; however, past development in this area has been restricted due to soil conditions unsuitable for on-site sewage disposal. Sewers are being planned for portions of the study area west of Congress Street. As a result of increased development in the Stroudwater area (encouraged by both the provision of sewers and the Arterial), Portland would gradually lose one of the large areas of natural open space remaining within the city.

The redistribution of traffic in the corridor will result in an improvement of air quality and noise environment in many areas, while most areas adjacent to the Arterial will experience a degradation in both of these aspects.

The adverse impacts that can be expected on the Fore River wetlands are the elimination of portions of the productive food web, reduction in carrying capacity and a reduction in scenic value. The disturbance of soil in the study area caused by highway construction will result in a temporary increase of erosion, turbidity and sedimentation in local streams. The introduction of pavement, graded slopes, and channelized drainage will increase rainfall runoff and stream flows which could result in changes in stream erosion, turbidity and sedimentation. The proposed action, lying within the drainage basin of the Fore River, will have direct, short-term adverse impacts to water quality in the estuary.

(5) Alternatives Considered

Several alternatives were objectively considered as possible solutions to the transportation needs in the Brighton Avenue corridor. These alternatives included Do-Nothing, Improve-the-Existing, six alternate alinements on new location, as well as other modes of transportation. Of these alternatives, four new location alinements--designated Lines A, B, B-1 and C--emerged as viable alternates, and two others (D and E) were eliminated because they did not satisfy the project objectives. The impact of Lines A, B, B-1 and C are described below in terms of seven major environmental impact categories.

Regional and Community Growth

The concept of an east-west arterial is generally consistent with the needs of the region and with the overall goals and objectives of the City of Portland. All of the alternate locations will promote the desired community growth and serve the regional transportation requirements, although not equally so. Future development should be nearly the same for all lines, while traffic service in the project area, based on the removal of traffic from Brighton Avenue, will be best served by the more northerly lines (A, B and B-1), rather than Line C. On the other hand, Line C will provide the best access to the Portland International Jetport.

Conservation and Preservation

Soil erosion and sedimentation, although controlled by the best available methods, are bound to occur, at least during the construction period. Considering each line on the basis of length, Line B (2.8 miles) would have 25% of its length in cut sections including 60% of the cut on highly erodible soils. Of the 75% of the length to be filled, 70% would be in water. The 2.75-mile long Line A (51% cut sections of which 48% would be on highly erodible soil) would have an erosion potential 1.7 times that of Line B.

The 2.8-mile long Line B-1 (44% cut sections of which 82% would be on highly erodible soil) would have an erosion potential 1.5 times that of Line B.

Similarly, Line C--the longest route at 3.5 miles--would have 68% cut sections of which 63% would be on highly erodible soils, representing an erosion potential of 3.0 times that of Line B.

Saltmarsh and coastal saltmeadow will be displaced by all alternates. Line B would displace the greatest combined acreage, followed by Lines B-1, A and C. Upland vegetative displacements would be greatest for Line C, while the other three lines would displace nearly the same amount.

Line A would have no significant impact on historic elements. Lines B and B-1 would displace approximately 5,600 feet and 3,000 feet, respectively, of the line of the former Cumberland and Oxford Canal. Line C could cross a site of former Canal locks, and would also displace the historic Francis Fickett House.

Public Facilities and Services

Although the growth associated with the Westbrook Arterial will create the demand for increased municipal services (fire, police, schools, recreation facilities) the tax revenue generated as a result of industrial, commercial, and high-quality, low-density housing should more than offset the increased expenses incurred by the City. It should also be considered that the efficiency and speed with which some of these municipal services (fire, police, ambulance service) can be delivered will be increased by the development of an east-west Arterial link.

Community Cohesion

The rural nature of the Stroudwater neighborhood will be adversely affected, primarily by Line C. However, residential development, subsequent to planned sewer installation, is already planned. Construction of the Westbrook Arterial should stimulate economic growth and increase property values. Industrial, commercial and residential development is planned for the area and should be enhanced by the project. Local tax revenue loss due to acquisition of right-of-way would be greatest for Line A, followed by Lines C, B-1 and B; however, the revenue losses are minimal and new development will recoup them in a short time.

Displacements of Families, Businesses and Farms

Line A would displace 34 families and 4 businesses; Line B would displace 3 families and 2 businesses; Line B-1 would displace 7 families and 2 businesses; and Line C would displace 14 families, one farm and 2 buildings from the Brooklawn Memorial Cemetery. A conceptual relocation survey indicates that replacement sites would be generally in adequate supply; however, relocation of all those affected would have to be accomplished in accordance with Federal and State requirements before a construction contract is put out to bid.

Air, Noise and Water Pollution

Air quality in the study area will not be significantly, adversely affected; in fact, enhancement of the ambient air quality would occur in many areas. Due to reduced traffic volumes, air quality on Brighton Avenue would be more enhanced by Line A, somewhat less by Lines B and B-1, and considerably less by Line C. On a study area basis, construction of any one of the lines would cause a reduction in total emissions of carbon monoxide, would not significantly affect hydrocarbon emissions, and would produce a slight increase in nitrogen oxides.

Construction of the Arterial would result in 1994 L_{10} noise levels exceeding the FHWA design noise level of 70 dBA for a varying number of Category B land uses: Line A, 8; Line B, 3; Line B-1, 4; Line C, 12. With the exception of 2 homes on Line A and one home on Line C, these land uses are presently impacted and would remain so under the Do-Nothing alternative. Because there is no practical means of providing noise abatement, the Bureau of Highways would request an exception to the design noise level for the presently impacted land uses and for the remaining home on Line C. Noise abatement would be provided for the 2 remaining impacted land uses on Line A.

Although there will be an increase over ambient levels along the Arterial, developed areas where noise intrusion could not be minimized easily are not extensive. Line B would impact (i.e., result in an increase of more than 5 dBA) 5 homes on outer Stroudwater Road, one home on Cliff Street, and 12 homes in the Fenway Street-Hobart Street area. Line B-1 would impact 3 homes on Stroudwater Road, 4 homes on Cliff Street, and one home on Hobart Street. Line C would impact 8 homes in the Fenway Street-Hobart Street area.

There are no widespread, continuous aquifers in the study area to be affected. All effects on groundwater would be confined to the immediate highway area. Surface waters will be affected generally by the introduction of materials from erosion caused by the cuts and fills during the construction period. Line A would affect the Fore River marshes west of Congress Street, but the impact should be minimal. Line B would require a 1,700-foot fill in the Fore River channel area, requiring channel relocation, with the resultant introduction of heavy metals from bottom deposits. Line B-1 would have similar impacts as Line B, but to a lesser degree. Line C would also require large quantities of fill in water areas, but the adverse effects are expected to be minor and short-term.

Aesthetics and Other Values

The proposed Arterial will generally be an intrusion upon the natural setting of the Fore River wetlands. The view of the road will vary depending on which line is chosen; however, appropriate landscaping of the new facility should reduce the impact. The view from the road, overlooking sections of the Fore River estuary, will be pleasing to the highway user.

(6) Federal, State and Local Agencies from which comments are being solicited.

Federal:

Department of Transportation, Coast Guard
Department of Agriculture
    Soil Conservation Service
Department of Commerce
Department of the Army
Department of the Interior
Department of Health, Education and Welfare
Department of Housing and Urban Development
Environmental Protection Agency
Office of Economic Opportunity

State:

Department of Inland Fisheries and Game
Department of Sea and Shore Fisheries
Forest Service
Department of Agriculture
    Soil and Water Conservation Commission
State Planning Office
Department of Parks and Recreation
Department of Education and Cultural Services
    State Museum Bureau
Department of Environmental Protection
Department of Commerce and Industry
Department of Health and Welfare
Maine Turnpike Authority
Maine Historic Preservation Commission

Regional:

Cumberland County Commissioners
Greater Portland Council of Governments
Portland Area Comprehensive Transportation Study
    Technical and Policy Committees

Local:

City of Portland
    Mayor
    City Manager
    Department of Public Works
    Department of Economic Development
    Department of Planning - Planning Board
    Conservation Commission

City of Westbrook
    Mayor

I. DESCRIPTION OF PROPOSED ACTION AND OF STUDY AREA

A. INTRODUCTION

1. Location

The study area is located in the city of Portland, Maine. An urbanized area, Portland is one of the primary centers for trade, finance and distribution for northern New England. The city is located on the Maine coast about 110 miles north of Boston, Massachusetts.

The study area for the Westbrook Arterial environmental impact statement lies to the southwest of the downtown area of the city and is approximately 2.5 miles long by 1.8 miles wide (Figure 1). It is bounded generally on the east by I-295, on the west by I-95 (Maine Turnpike), on the south by the Portland International Jetport and on the north by Brighton Avenue.

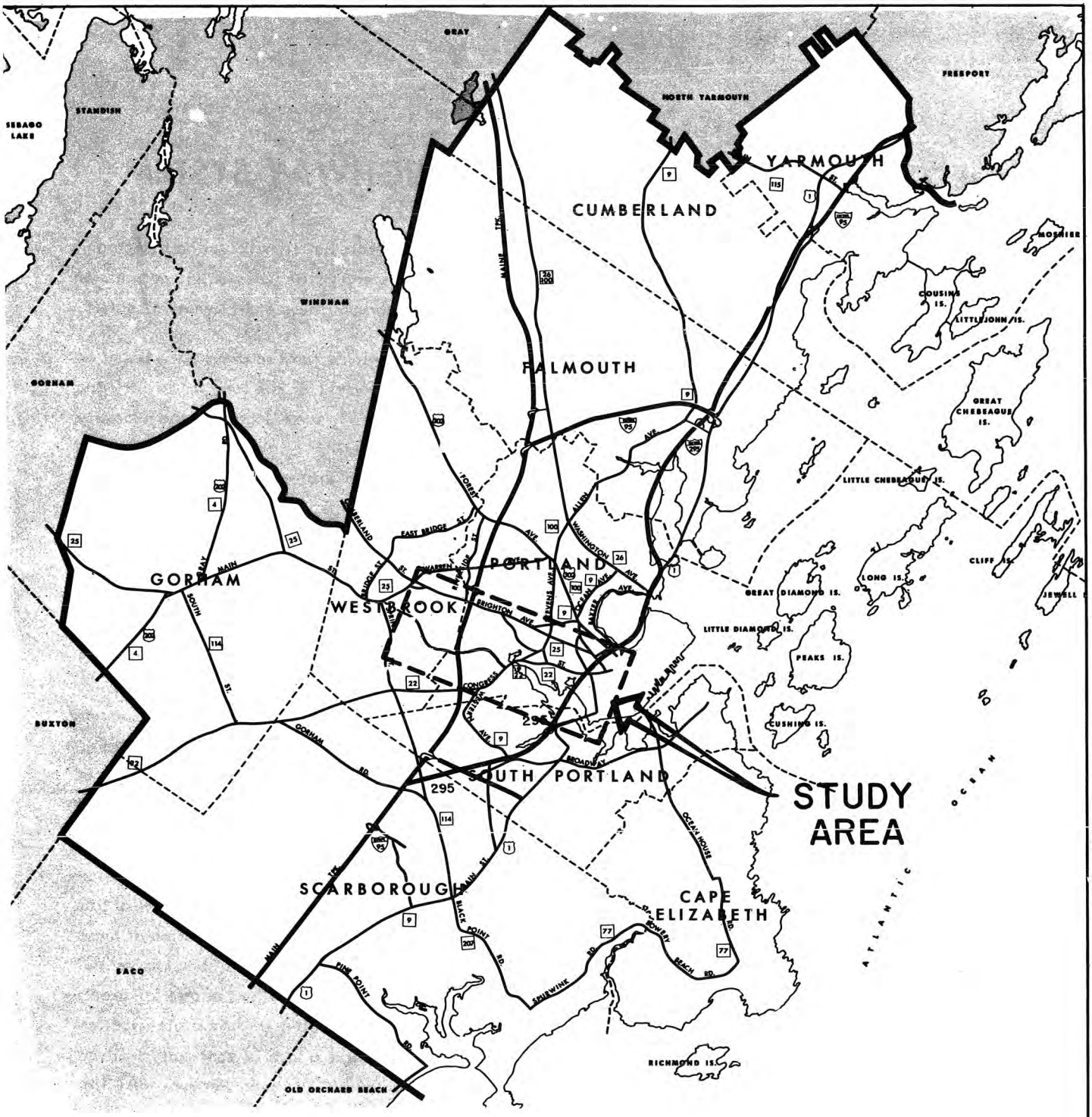
2. History of Proposed Action

The need for an east-west connection between the city of Portland and the city of Westbrook was first promulgated by the Portland Planning Department in 1952. In 1957 the location for I-295 was determined and this action originated the first potential location for the Westbrook Arterial. More recently, however, the Portland Area Comprehensive Transportation Study (PACTS), published in 1965, and the PACTS Updating Study, published in 1970, delineated the need for such a facility and recommended a general alinement of the so-called Westbrook Arterial route.

A public hearing was held regarding the Westbrook Arterial proposal in Portland City Hall on August 10, 1965. At that time pertinent data regarding the proposal were reviewed with the public. Subsequent to the public hearing, the Maine State Highway Commission (now the Maine Department of Transportation) entered into project agreements with the cities of Portland and Westbrook for the construction of a Westbrook Arterial and related roadways. These agreements occurred in the fall of 1965.

In connection with the construction of the Westbrook Arterial, application was made by the Maine State Highway Commission for a permit to fill certain wetlands. This application was reviewed on June 28, 1972, and a vote to table the application was made by the then Wetlands Control Board. At this point it was decided by the Maine State Highway Commission to proceed with a formal Environmental Impact Statement as provided for under the National Environmental Policy Act.

As required by law, this Environmental Impact Statement considers various alternatives to the proposed action as well as various alternate alinements for the action. These alternatives and alinements reflect suggestions made by the general public, City of Portland officials, the Maine Department of Transportation, and other State agencies. Many of these suggestions were made at



MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

ENVIRONMENTAL IMPACT STUDY
WESTBROOK ARTERIAL • WESTBROOK-PORTLAND

Prepared by :
Edwards and Kelcey

Scale in Miles
1 mi. 0 1 2 3 mi.

LOCATION MAP

FIGURE 1

informational and input meetings held with concerned citizens' groups, City officials and state agency personnel. These meetings were held to attempt to keep all interested parties informed of the study process and in order to gather data for preparation of the environmental impact statement.

As a result of previous agreements with Portland and Westbrook, Wayside Drive, which provides relief to Westbrook's business district, has been constructed, as have the northerly portions of the Westbrook and Portland Connectors. The westerly portion of the Arterial is presently under construction between Wayside Drive and the Westbrook Connector. Excess excavation material generated during construction of the Westbrook portion of the Arterial has been used to construct embankment for the remaining portion of the Arterial from the Westbrook Connector to the Maine Turnpike. This decision was made in an attempt to avoid creating disposal problems in another area, to provide for a balanced cut and fill effort and to initiate some soil stabilization procedures in this area. The environmental impact statement concerns itself with the impact of paving and grading this area, but the remaining portion of the proposed Arterial from the Maine Turnpike to Sewall Street near I-295 is the portion that will be addressed primarily.

3. Purpose of Proposed Action

There are many and varied reasons why a major arterial highway facility westerly from Portland towards the center of Westbrook is important to area transportation. Reasons that are particularly relevant include improved traffic service and relief of congestion on Brighton Avenue and on the surrounding street and highway network, accident reduction in the corridor, fulfillment of commitments made for both recent development and planned development in anticipation of the project, improvement in land development potential and enhancement of the economic viability of downtown Portland.

a. Traffic Considerations

Traffic Service

A major justification of the Westbrook Arterial is the necessity to provide a highway facility which would serve the expected future traffic demands in the Brighton Avenue corridor. Brighton Avenue, as will be discussed later, does not have the capacity to handle increased traffic volumes without major street widening. Such widening would entail major land use impacts on adjacent residences and businesses and would be detrimental to the highly residential character of the area through which Brighton Avenue, for the most part, traverses. Assuming the capacity of Brighton Avenue could be increased significantly, it would still not offer the same service to the through motorist as would be provided by a controlled access facility such as the Westbrook Arterial.

The benefits of an arterial route would also be felt on Westbrook Street from Stroudwater to Westbrook and on Congress Street between Libbytown and Stroudwater.

Aside from the need to serve future traffic demands in the area, the Westbrook Arterial would provide a new gateway between the downtown areas of Portland and Westbrook-Gorham and other westerly areas of the state.

In addition to the impact on downtown Portland, the Arterial would provide quick and easy travel for workers' daily trips to and from their jobs in the industrial and commercial establishments of both Portland and Westbrook. Access to the expanded Portland International Jetport from the westerly regions of the state and from the Maine Turnpike (Interstate 95) via Exit 8 would also be improved with the completion of the Westbrook Arterial route.

Improvement in travel to, from, and between the University of Maine campuses at Portland and Gorham is an additional benefit which would be realized with the construction of an Arterial.

The Brighton Avenue corridor is served by two parallel eastwest roadways. The principal roadway, Brighton Avenue (State Route 25) serves as the only arterial linking the Westbrook-Gorham area with downtown Portland. This roadway, with physical and operational characteristics of an urban city street, carried some 20,360 vehicles daily (1973 annual average daily traffic) at a location between the Portland Connector and Capisic Street.

The other corridor roadway, namely Westbrook Street which becomes Stroudwater Street in Westbrook, is primarily a residential street serving 4280 vehicles daily (1973 annual average daily traffic) at the Portland-Westbrook town line. Although Westbrook Street is functioning as a logical secondary connector for through trips between the Westbrook-Gorham area and the areas of Portland-South Portland served by outer Congress Street, Westbrook Street is also burdened by through trip motorists traveling between downtown Portland and the Westbrook-Gorham area that, to avoid traffic congestion which exists on Brighton Avenue, travel the more circuitous route through Stroudwater. Residential use along Westbrook Street is characterized by homes of distinct flavor. Construction of the Westbrook Arterial would substantially reduce traffic volumes on this street.

An examination of PACTS data disclosed the high magnitude of Brighton Avenue corridor through trips; the need for a highway improvement within the corridor to adequately serve the through trip demand was underscored. This information indicates that at the present day traffic level, over 7,000 through vehicles daily (which includes 420 heavy trucks) travel between the Westbrook-Gorham area and the Portland Peninsula. Expected traffic increases in the corridor over the next 20 years could expand this traffic demand to over 13,000 vehicles at the 1994 Annual Average Daily Traffic level. This through traffic, when added to the basic land service volumes and shorter distance trips, places a significant burden on the Avenue.

Future Traffic Demand

Brighton Avenue corridor traffic demand is expected to exceed 50,000 vehicles at the 1994 annual average daily traffic level. If Brighton Avenue and Westbrook Street were expected to carry the future traffic demand without the

Westbrook Arterial, then Brighton Avenue and Westbrook Street would have approximately 31,700 and 16,100 vehicles, respectively. The remainder of the corridor traffic of approximately 1200 vehicles would utilize the peripheral roadway system. The total computed capacity of Brighton Avenue and Westbrook Street is estimated at about 41,600 vehicles per day at level of service E. This low level of service represents volumes at or near the capacity of the highways, with speeds varying in the area of 15 miles per hour. At level of service C (the normal design level of service) the total corridor capacity is about 34,600 vehicles per day. Under either service level, there will be a significant traffic capacity deficiency which can only be alleviated by improvements within the corridor.

The effect of the energy situation on future traffic demands has been considered. At the present time, gasoline is generally available. Traffic, especially in urban areas where the majority of trips are commuter type rather than long distance, is almost at normal volume. In the long term it is expected that a basic level of required fuel will be available and that the predicted traffic volume for the Brighton Avenue corridor will materialize within the 20-year period, for the following reasons:

Less fuel used per vehicle with the auto industry's sharp swing to smaller cars. By the end of 1974, more than half the industry's capacity will be committed to compact and subcompact cars.

Alternate transportation means (such as mass transit, as discussed later in this report) not expected to become a dominant transportation mode in the Portland area.

Lower speed limits with decreased fuel consumption.

Increased oil exploration and the goal of the nation to be energy self-sufficient in 10 years.

Energy conservation by many homes and businesses with simple measures such as turning off lights and heat in unused rooms.

Builders conserving energy by building houses with better and more insulation to keep heat in to save heating oil.

An anticipated transition to coal and coal derivatives by present stationary petroleum users such as utilities and heavy industry.

Potential development of other fuel sources for individual vehicle transportation.

Traffic Accidents

Accident statistics for a three-year period (1970-1972 inclusive) indicate that a total of 537 traffic accidents have occurred on sections of State Route 25 (Brighton Avenue in Portland and Main Street in Westbrook) between Deering

Avenue in Portland and Cumberland Street in Westbrook. The highest accident rates (accidents per hundred million vehicle-miles) of 1295 and 926 were computed for sections of Brighton Avenue between Deering and Stevens Avenue and between Capisic and Riverside Street (just west of the Turnpike), respectively. These rates, especially the very high rate of 1295 for the Brighton Avenue roadway section between Deering and Stevens Avenue are higher than the Statewide Primary Highway rate of 908 accidents per hundred million vehicle-miles for the same period of time. Other sections of this roadway showed rates which are slightly lower than the statewide average, ranging from 809 to 895.

A new highway improvement should significantly improve the overall traffic accident rates for the Brighton Avenue corridor. The proposed new controlled access facility and its accompanying high design standards minimize conflicts with other traffic and the number of required decisions on the part of motorists.

Based on the composite results of two separate studies (The Federal Role in Highway Safety, and Interstate System Accident Research), it is indicated that the accident rate (accidents per 100 million vehicle-miles) for highways will full control of access is 62 percent lower than that of a highway without access control.

A 1965 California Study (Highway Research Board Record 225) indicated the accident cost per mile driven (direct accident cost, excluding the indirect cost of fatalities) for urban freeways was 0.21 cent as compared to the non-freeway cost of 0.69 cent.

The removal of through traffic from Brighton Avenue will significantly lower the existing accident rates for this roadway.

Mass Transit

The extent of impact other modes of transportation will have on present and future travel needs in the Brighton Avenue corridor is described in detail in Section I.A.4., Alternatives, beginning on page 8.

b. Economic Viability

Adequate highway access between downtown Portland and all neighboring communities is a necessary factor to the revitalization of "in-town" Portland, a better than $60 million task which is currently underway and for which east-west access to the Peninsula of Portland from both the north and south regions of the State is satisfactorily provided by major routes such as the Interstate and U.S. Route 1, while no major arterial highway is currently available for travel between the Peninsula and westerly areas. The Westbrook Arterial would provide a new gateway between the downtown areas of Portland and Westbrook-Gorham and the more westerly areas of the State.

The economic importance of the Portland Peninsula to the City of Portland is emphasized by tax valuation figures for the year 1973. These figures show that of the City of Portland's total real estate valuation of almost $295 million, slightly over $118 million, or approximately 40 percent of the entire real estate valuation of the City, is peninsula oriented. It is estimated that the Peninsula also accounts for 40 percent of the City of Portland's $72 million personal property tax valuation.

The revitalization of the Peninsula is indicated by the number of new businesses, warehouses, housing, office and apartment complexes which have been added to Portland's tax base. In the past three or so years, some 26 parcels of property, each with valuations of $100 thousand or more, have been developed on Portland's Peninsula. Some of these properties are the Canal Plaza, Casco Bank Building, Holiday Inn, Maine Savings Bank, and Blue Cross-Blue Shield. Presently ongoing is the Maine Way Plaza as well as the planning for the Cumberland County Recreational Center.

c. Land Use Considerations

An economic benefit which could be realized with the construction of the Westbrook Arterial would be the increased development opportunity for the open land in both Westbrook and Portland adjacent to the Arterial. The Portland Connector would provide access to an estimated 630 acres of developable land, of which 502 acres are zoned residential. Access opportunity provided by both the Portland and Westbrook Connectors for industrial zoned land would be approximately 518 acres. Some of this development has already taken place in the two communities.

As an indication of the potential economic impact a controlled access facility can have on an area, the 1963 report, The Interstate--Its Impact on Industrial Development in Bangor, indicates that in three years subsequent to the completion of Interstate Route 95 through Bangor, the City of Bangor realized an increase in valuation of almost 4 million dollars. The report further states that as a result of the construction of Interstate 395, the so-called "Industrial Spur", there had been an increase in the demand for sites in the Industrial Park area which lies adjacent to Interstate 395. In almost every case, according to the report, the interested firms desired to be along a major highway for prestige, advertising value, and commuting ease.

d. Commitments

One of the strongest elements supporting the necessity for and completion of the Westbrook Arterial is the large existing commitment of private and public capital based on agreements arrived at in the mid-1960's.

The J.L. Morin Company has located adjacent to the Westbrook Connector, while the firms of Emery Waterhouse and Forest City Chevrolet have taken the opportunity to locate adjacent to the Portland Connector. Although not documented, it is felt that many additional, perhaps lesser, private decisions related to investment or deferral of investment have hinged on the earlier commitments

made regarding the existence and basic configuration of the Arterial facility. It is reasonable to presume that other decisions await resolution of the details of configuration, given the premise of the existence of the basic facility.

The mainline of the Arterial is presently under construction between the Westbrook Connector and Wayside Drive. Wayside Drive, which provides traffic relief to Westbrook's business district, has been completed from the Westbrook Arterial westerly. With the completion of the Arterial, through traffic using the Westbrook Arterial and destined for the Gorham-Windham area would be channeled around the central business district of Westbrook. The two connectors, namely, Westbrook and Portland, have also been constructed. The Westbrook Connector would provide access to the Arterial from the commercial areas of Westbrook and from Exit 8 of the Maine Turnpike (Interstate 95) via Larrabee Road. In addition to providing traffic service between the Arterial and many major traffic generators along Brighton Avenue, the connectors would service traffic between the Maine Turnpike at Exit 8 and the Portland International Jetport. In anticipation of future demands the Maine Department of Transportation has acquired, or will acquire, sufficient right-of-way for the future provision of full interchanges at the Maine Turnpike and at the Westbrook and Portland Connectors.

4. Alternatives

The Bureau of Highways has objectively considered several alternatives as possible solutions to the transportation needs in the Brighton Avenue corridor. These include the Do-Nothing and Improve-the-Existing alternatives, six alternate alinements on new location, and other modes of transportation. Significant disadvantages of several of these alternatives became apparent early in the study.

a. Do-Nothing

As described earlier, the projected traffic demand in the Brighton Avenue corridor significantly exceeds the capacities of Brighton Avenue and Westbrook Street. The PACTS studies underscored the need for a highway improvement within the corridor to adequately serve the through traffic demand. At level of service C (the normal design level of service) the corridor capacity is 34,600 vehicles per day; by 1994, demand volumes in the corridor will exceed this capacity by nearly 45%. As described earlier, adequate highway access to downtown Portland is essential to the revitalization of "in-town Portland"; to do nothing ignores this basic fact. This alternative also would not provide the increased opportunity for land development in the project area and the benefits of reduced accidents in the corridor, nor would it honor the earlier commitments made with regard to the proposal.

b. Improve-the-Existing

This alternative could consist of improving Brighton Avenue to a six-lane highway and possible improvements to Westbrook Street to increase its capacity.

Widening of Brighton Avenue would result in severe land use impacts. Because of the shallow setback of many buildings on this street, the number of displacements would be high, and the remaining properties would be subject to continued adverse impacts with respect to air quality and noise. On-street parking would be restricted, adversely affecting roadside commercial outlets which do not have facilities for off-street parking. In view of the at-grade intersections, and lack of access control, accident rates on Brighton Avenue would not be reduced. The facility would still not offer the same service to the through motorist as would be provided by a controlled access facility. Improvements to Westbrook Street would also result in encroachment on the shallow setbacks of existing historic residential areas in Stroudwater with attendant negative impacts (e.g., noise and air quality) created by a projected 1994 ADT of 16,130 vehicles.

c. Alternatives on New Location

The Bureau of Highways has developed four basic location and design alternatives, designated as Lines A, B, B-1 and C. These alternates are more fully described in Section I.B., Summary of Engineering Data, beginning on page 14. Two additional alinements, designated Lines D and E, were suggested during informal meetings held with various interested groups in the Portland area. The several alinements are shown on Figure 2, page 13.

Line D would basically proceed southerly from the Westbrook Connector, paralleling the Maine Turnpike on new alinement to an overpass in the vicinity of the Portland-South Portland city line. From this point Line D would proceed easterly, interchanging with Johnson Street and a new airport access road, then cross the Fore River just north of the Portland International Jetport runway.

Line E would proceed easterly from the Westbrook Connector and interchange with the Maine Turnpike then proceed southerly using the Maine Turnpike to Exit 7 in South Portland where it would connect with I-295 which would be used as access to downtown Portland. A variation of Line E would include a continuation from the turnpike easterly, ending at the Portland Connector.

Specific traffic assignments to these proposals have not been made. However, a comparison with assignments made for Lines A, B, B-1 and C has been made. The following analysis is presented for Line D which is the least circuitous of the two proposals for vehicles traveling in an east-west corridor. However, the same comments associated with Line D are basically inherent in a Line E that does not extend to the Portland Connector, with the exception that Line E would be considerably more circuitous for east-west travel. With reference to Line D, the following is noted:

> Travel time and distance for those trips between Westbrook and Portland would be significantly increased by approximately 2.0 minutes and 1.5 miles over Line B and 1.4 minutes and 0.8 miles over Line C. These differences would have accompanying economic and environmental consequences.

Based on significantly increased east-west travel time, it can safely be stated that through corridor trips would be substantially reduced on Line D over through trips for Lines A, B, B-1, or C. This reduction would tend to obviate the advantages of constructing Line D, because the basic purpose of the Westbrook Arterial is to alleviate traffic on Brighton Avenue. Of Lines A, B, B-1 and C, Line C would reduce Brighton Avenue traffic the least. Line D would be even less effective.

In the vicinity of the southerly Line D-Maine Turnpike overpass, Line D would be competing for land usage with the potential relocation of Johnson Street, which would be necessitated by an extension westerly of the principal Portland International Jetport runway, as proposed in the Airport Master Plan Report.

Service is not provided to and from the major Brighton Avenue traffic generators which are served by Lines A, B, B-1 and C via the Portland Connector.

Line D would not significantly relieve traffic on Brighton Avenue and would cost approximately $500,000 more to construct than Line C and several million dollars more than Lines A, B or B-1.

Line E, while costing the least to construct, would--if terminated at the turnpike--be extremely circuitous and would provide miniscule and inconsequential relief to Brighton Avenue for east-west corridor travel. The Line E variation extending to the Portland Connector would offer minimal additional advantages. The interchange with the turnpike would essentially be a logical future connection provided in an attempt to utilize already completed sections of the Arterial, but would not alone be meaningful in accommodating corridor traffic. As is the case for Lines A, B, B-1 and C, it would not be practical to provide a connection until the turnpike becomes toll free.

Line E would, to a large degree, be competing with the existing roadway system. Spring Street, which traverses between the Westbrook Central Business District and Exit 7 of the Maine Turnpike in South Portland, provides a more direct connection for vehicular trips between the two areas in question thereby reducing the need for Line E.

d. Other Modes of Transportation

Bus service in the Brighton Avenue corridor is provided by the Greater Portland Transit District. The District consists of and receives subsidies from the municipalities of Portland, South Portland, Westbrook and Cape Elizabeth. Through federal grants from the Urban Mass Transit Administration, the Transit District has recently purchased new buses and anticipates future grants for an additional 35 buses which will update the District's entire rolling stock.

Public Transit in Greater Portland, 1971, a report prepared for the Greater Portland Council of Governments, states that nationwide experience reveals that conventional bus operations in small cities of low population density

similar to Greater Portland cannot be profitable as an exclusively private enterprise operated for private profit. The report further indicates that there are two groups of public transit users in Greater Portland: those patrons who use it for convenience; and the predominant group who are the vital core of public transit users, those persons who use it primarily because they lack alternative means afforded by the automobile or taxi.

The existing bus route via Brighton Avenue provides frequent and underutilized service between the downtown area of Portland and the Westbrook area. At the present time, the Transit District maintains over 40 round trips per weekday, during the time period of approximately 5:00 a.m. to midnight, between downtown Portland and Westbrook. The present route originates at the junction of Forest Avenue and Congress Street, circulates through downtown Portland, and terminates in the downtown and industrial areas of Westbrook. The route follows Forest Avenue, Woodford Street, and Brighton Avenue in Portland, and Main and Cumberland streets in Westbrook.

Ridership statistics (either present day number of riders or historical numbers), are presently unavailable for the Brighton Avenue route, although an average load factor of 50% is estimated by the Maine Department of Transportation. Information obtained from the Transit District also indicates an estimated per- mile income of less than seventy cents ($0.70). This per-mile income is somewhat less than the ninety cents ($0.90) per mile the Transit District needs to meet "out-of-pocket" operational and maintenance requirements alone.

It is reasonable to conclude that public bus service in the Brighton Avenue corridor is an essential transportation element. However, from available information relative to load factor and anticipated service areas, a conclusion also can be made that bus transit does not presently, nor is it expected to exert a major influence in the near future on the movement of people between downtown Portland and the Westbrook area. On the other hand, a highway improvement within the Brighton Avenue corridor would complement bus transit by relieving traffic congestion on the existing bus route.

The Portland Terminal Company furnishes freight rail service within the corridor. The rail facility consists of a single track line, running approximately parallel to and south of Brighton Avenue. At the present time, this rail line serves two through freight movements daily between the Rigby Yard in South Portland and St. Johnsbury, Vermont, where the line joins the Canadian Pacific Railroad. In addition, this line also serves four switching movements (including the S.D. Warren mill) between downtown Westbrook and the South Portland Rigby Yard.

The use of this available track for commuter rail service between Westbrook and the Portland area does not appear to be a viable alternative for passenger transportation between the two communities. In the first place, the railroads involved have shown little enthusiasm for initiating rail passenger service in the State. Secondly, rail passenger service in the Brighton Avenue corridor would directly compete for the patronage with a subsidized bus system, which is already providing frequent and direct passenger service between the downtown areas of Portland and Westbrook.

Other important factors which would have to be given consideration in the initiation of rail passenger service in the Brighton Avenue corridor are:

Cost of rolling equipment - a logical choice of equipment could be Budd cars, estimated to cost one-half million dollars ($500,000) each, with a minimum order of 20 cars.

Terminal Buildings - some type of shelter would need to be available to protect rail passengers from the elements at the route terminals. It would also be desirable to construct parking facilities at these locations.

Ridership - as previously stated, the present bus system provides patrons with frequent and direct service between the downtown areas of Portland and Westbrook. Although rail patrons within downtown Westbrook would be provided convenient service, track configuration within the Portland area could necessitate terminals at one or more of the following locations: Congress and St. John streets, Forest Avenue and State Street, and the Commercial Street area. All of these locations are somewhat removed from Portland's downtown area. In addition, the frequency of rail service would not be as great as that of bus service. Presently, only one rail track services the area; operation over this one line would require mixing passenger and freight service.

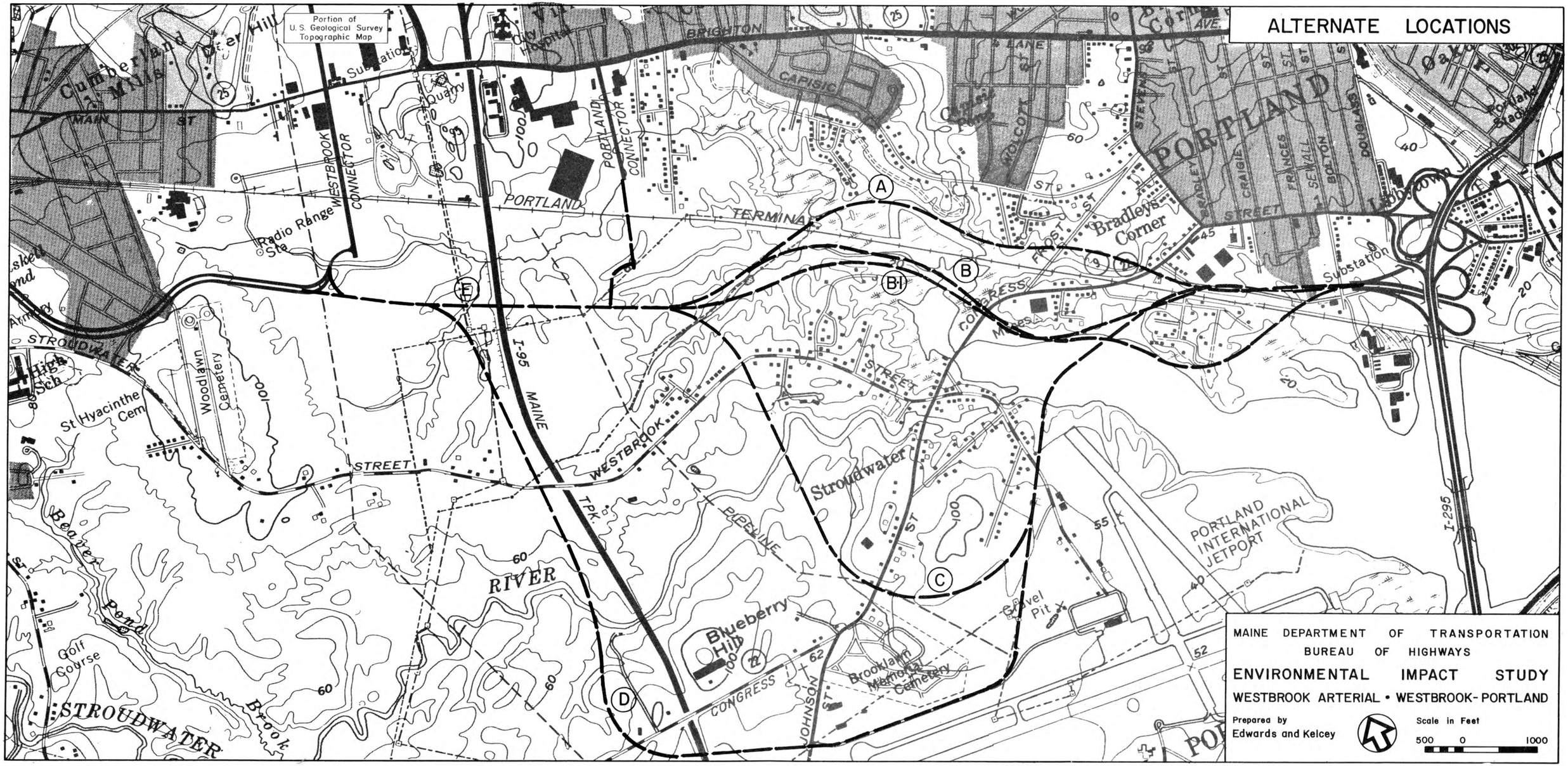
The trend towards the acceptance of rail public transportation over that of the private automobile for basic commuting in urban areas has not been promising. A report published in 1972 for the Massachusetts Bay Transportation Authority indicates railroad suburban passenger ridership from the late 1940's to the present (i.e., inbound weekday passengers to Boston's North and South Stations via Boston and Maine and Penn Central, respectively) has declined over 80 percent. It should be noted, however, recent information has indicated that suburban passenger ridership has increased to a small degree (assumed due to present energy problems), although ridership is still substantially less than in the late 1940's.

In considering water transportation there are three existing structures which cross the Fore River downstream from the proposed action. Two of these structures are fixed spans.

There are two existing structures which cross the Fore River in the vicinity of the proposed action (Congress Street Bridge and Portland Terminal Railroad tracks).

The proposed action would not further restrict navigation and would provide for the use of the Fore River in a fashion which is compatible with present navigable facilities.

The proposed action is subject to review by the United States Coast Guard with regard to navigability and is subject to the issuance of a permit by this Agency.


ALTERNATE LOCATIONS
Portion of U.S. Geological Survey Topographic Map
A
B
B-1
C
D
E
PORTLAND TERMINAL
PORTLAND CONNECTOR
WESTBROOK CONNECTOR
I-95
MAINE TPK.
PIPELINE
CONGRESS STREET
WESTBROOK STREET
STROUDWATER
Bradleys Corner
Blueberry Hill
Brooklawn Memorial Cemetery
Woodlawn Cemetery
St Hyacinthe Cem
Radio Range Sta
Substation
Gravel Pit
PORTLAND INTERNATIONAL JETPORT
I-295
Golf Course
Beaver Pond
STROUDWATER River
MAINE DEPARTMENT OF TRANSPORTATION
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ENVIRONMENTAL IMPACT STUDY
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Scale in Feet
500 0 1000

FIGURE 2

B. SUMMARY OF ENGINEERING DATA

1. Description of Alternates

In an effort to fulfill the purpose of the proposed action, several alinements have been developed. Various degrees of input by private citizens and groups have aided the Bureau of Highways in the development of possible solutions to upgrading the transportation corridor. Those lines which have emerged as viable contenders are Lines A, B, B-1 and C.

Each of the "build" alternates offers a four-lane, divided expressway with full access control beginning at an intersection with the Westbrook Connector and ending at the I-295 interchange. In the Westbrook Arterial project now under construction in Westbrook, complete right-of-way has been taken up to the existing right-of-way of the Maine Turnpike, and the embankment has already been placed within this right-of-way. Only paving and grading work will be accomplished on the section from the Westbrook Connector to the Turnpike for the project under consideration. Consequently, although this environmental impact statement begins coverage at the Westbrook Connector, many of the impacts for the proposed construction begin, instead, at the Turnpike. Similarly, the interchange of the Arterial with I-295 is being constructed as an integral part of I-295. The portion of the Westbrook Arterial for which this environmental impact statement is being prepared terminates at Sewall Street, immediately west of the I-295 interchange.

The typical right-of-way width is 325 feet, which varies in certain cut and fill areas and through interchanges as required. The median width varies from 20 to 44 feet, and the pavement width for each direction of travel includes two 12-foot lanes with a 10-foot right shoulder and a 4-foot shoulder along the median. Each of the alternates is described individually below.

a. Line A

Line A (Figure 3 on page 17) commences at the Westbrook Connector approximately 2,500 feet west of the Maine Turnpike (I-95). The line proceeds easterly, overpassing I-95 without an interchange to an at-grade, channelized intersection with the Portland Connector which is approximately 1,500 feet east of I-95. The design of this intersection allows for a full interchange in the future, for which the necessary right-of-way is being taken under this project. About 2,900 feet to the east the line bridges the Portland Terminal Company rail line. In this area the Arterial nearly parallels the abandoned Cumberland and Oxford Canal. The line then turns to the southeast and continues on the edge of the Fore River tidal area for about 3,900 feet, cutting off approximately 200 feet of Riverview Street and the cul-de-sac of Bancroft Court, and dead-ending Frost Street 1,000 feet easterly of its present intersection with Congress Street. A diamond interchange is provided with a relocated section of Congress Street overpassing the Arterial and the railroad. The relocation affects about 3,000 feet of Congress Street from a point approximately 400 feet northeast of the bridge at the Fore River to the Stevens Avenue intersection. The line continues easterly for about 3,700 feet to overpass a relocated Sewall Street. In this length the line passes between

the Westgate Shopping Plaza and the railroad and cuts off the end of Powsland Street. This easterly terminus of the project will tie into a full interchange with I-295. The length of Line A is approximately 2.75 miles.

b. Line B

Line B (Figure 4 on page 18) has the same alinement and design features as those described for Line A to the Portland Connector. From the Connector to the proposed Congress Street interchange, a length of approximately 5,600 feet, the line runs easterly displacing a portion of the abandoned canal, then southeasterly parallel to the railroad about 300 feet northerly of Stroudwater Road. It then runs through the westerly reaches of the Fore River tidal marshes; the section of the river adjacent to both sides of the railroad will flow through a structure to be constructed under the Arterial approximately 700 feet northwesterly of Congress Street. Upstream and southerly of the railroad, a new 2,000-foot drainage channel for the upper tidal areas will be constructed between the Arterial and railroad. Approximately 1,800 feet of Congress Street will be reconstructed from the Fore River bridge to Brewer Street. This work will include improvements to the bridge over the Fore River and a highway overpass of the Arterial in the proposed interchange area. The interchange will be a modified diamond type with a loop ramp in the northerly-most quadrant, westerly of the intersection of Frost and Congress Streets.

From the Congress Street interchange the Arterial continues to the southeast for about 3,000 feet, following the northerly bank of the Fore River and requiring an 1,800-foot channel relocation. The line then continues easterly for about 2,100 feet, bridging the railroad, cutting off the end of Powsland Street, and terminating at the overpass of relocated Sewall Street. The length of Line B is approximately 2.8 miles.

c. Line B-1

Line B-1 (Figure 5 on page 19) also has the same alinement and design features as described for Line A to the Portland Connector. From the Connector to the proposed Congress Street interchange, a length of approximately 5,200 feet, the line runs easterly crossing the abandoned canal, then paralleling it for about 2,800 feet on the sidehill area southerly of the tidal marsh. Most of the fill for the northerly roadway side slope avoids the tidal area. The Arterial crosses over the Fore River, which will flow through a structure located approximately 700 feet northwesterly of Congress Street.

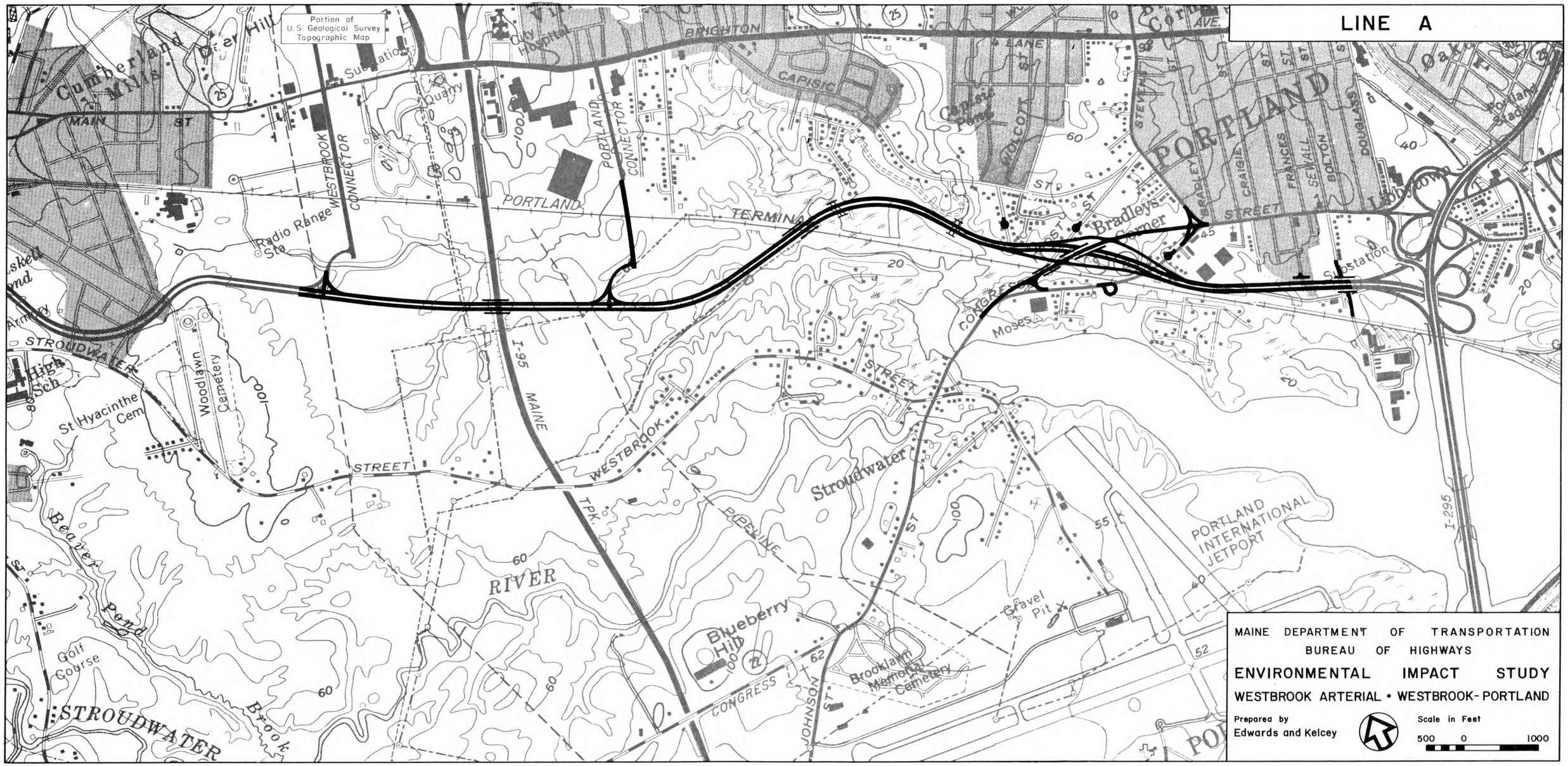
A modified diamond interchange is provided at Congress Street, which is to be reconstructed for about 1,900 feet from Waldo Street to Brewer Street. Included will be a new Fore River bridge and an overpass of the Arterial. The interchange will have a loop ramp in the southwest quadrant to serve eastbound traffic from Congress Street. From the Congress Street interchange, the Arterial continues to the southeast for about 1,000 feet, following the abandoned canal to a point to the south of Brewer Street, at which location the Fore River channel is relocated for about 900 feet due to embankment of the roadway section. The line then leaves the river area, continues easterly for

about 1,800 feet, underpassing both a raised Hobart Street and the railroad near Westland Avenue. The railroad will be raised about 8 to 10 feet and carried on a new bridge over the Arterial. It then continues another 2,400 feet nearly parallel to the railroad, cuts off a small length of Powsland Street and terminates at the overpass of relocated Sewall Street. The length of Line B-1 is approximately 2.8 miles.

d. Line C

Line C (Figure 6 on page 20) also has the same alinement features as described for Line A to the Portland Connector. From this point, the alinement is significantly different. The line heads south for about 2,000 feet, crossing the abandoned canal and passing under Westbrook Street, which will be realined approximately 100 feet to the south in this area. About 1,200 feet further south the Arterial bridges the Stroudwater River; another 2,200 feet to the south it interchanges with a relocated section of Congress Street just north of the Brooklawn Memorial Cemetery. Congress Street is to be reconstructed through the interchange area as a four-lane divided roadway with channelization for ramp turns. The interchange will be an elongated diamond type with the Arterial overpassing Congress Street. The line turns and continues in a northeasterly direction roughly paralleling Cobb Avenue, allows a direct connection to the Portland International Jetport from an at-grade, channelized intersection about 2,100 feet from the the Congress Street interchange, cuts through Westbrook Street, interrupting it as a through way, and proceeds to the Fore River at a point close to the end of Runway 18, a distance of another 2,100 feet. The Fore River crossing is accomplished by filled approaches to a 470-foot, multi-span bridge over the existing channel. The interchange for Congress Street will be a half diamond at a raised Hobart Street with access to and from the west only. The railroad will be raised about 8 to 10 feet and carried on a new bridge over the Arterial. This crossing is approximately 2,300 feet from the present southerly bank of the Fore River.

Hobart Street will be rebuilt and carried over the Arterial to about 200 feet east of present Westland Avenue. Congress Street is extended eastward about 300 feet and then turns northward across the new railroad grade crossing. The westbound ramp begins at this intersection. The off-bound ramp ends at Hobart Street, east of the Arterial. The Westland Avenue-Hobart Street intersection is moved eastward about 100 feet. From the railroad crossing Congress Street joins the existing street near the Westgate shopping center. From just north of the new railroad bridge over the Arterial, Line C continues another 2,300 feet and is essentially the same as Line B-1 to the terminus at Sewall Street. The length of Line C is approximately 3.5 miles.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Sub Station
Quarry
City Hospital
BRIGHTON
CAPISIC
WESTBROOK CONNECTOR
PORTLAND CONNECTOR
PORTLAND
TERMINAL
Radio Range Sta
Capisic Pond
WOLCOTT ST
PORTLAND
BRADLEY ST
CRAIGIE ST
FRANCES ST
SEWALL ST
BOLTON ST
DOUGLASS ST
STEVENS AVE
STREET
Bradleys Corner
Sub Station
CONGRESS
Moses
STROUDWATER
High Sch
St Hyacinthe Cem
Woodlawn Cemetery
I-95
MAINE TPK.
WESTBROOK STREET
PIPELINE
Stroudwater ST
PORTLAND INTERNATIONAL JETPORT
I-295
Beaver Pond
Golf Course
STROUDWATER RIVER
Brook
Blueberry Hill
Gravel Pit
Brooklawn Memorial Cemetery
JOHNSON ST
CONGRESS
MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS
ENVIRONMENTAL IMPACT STUDY
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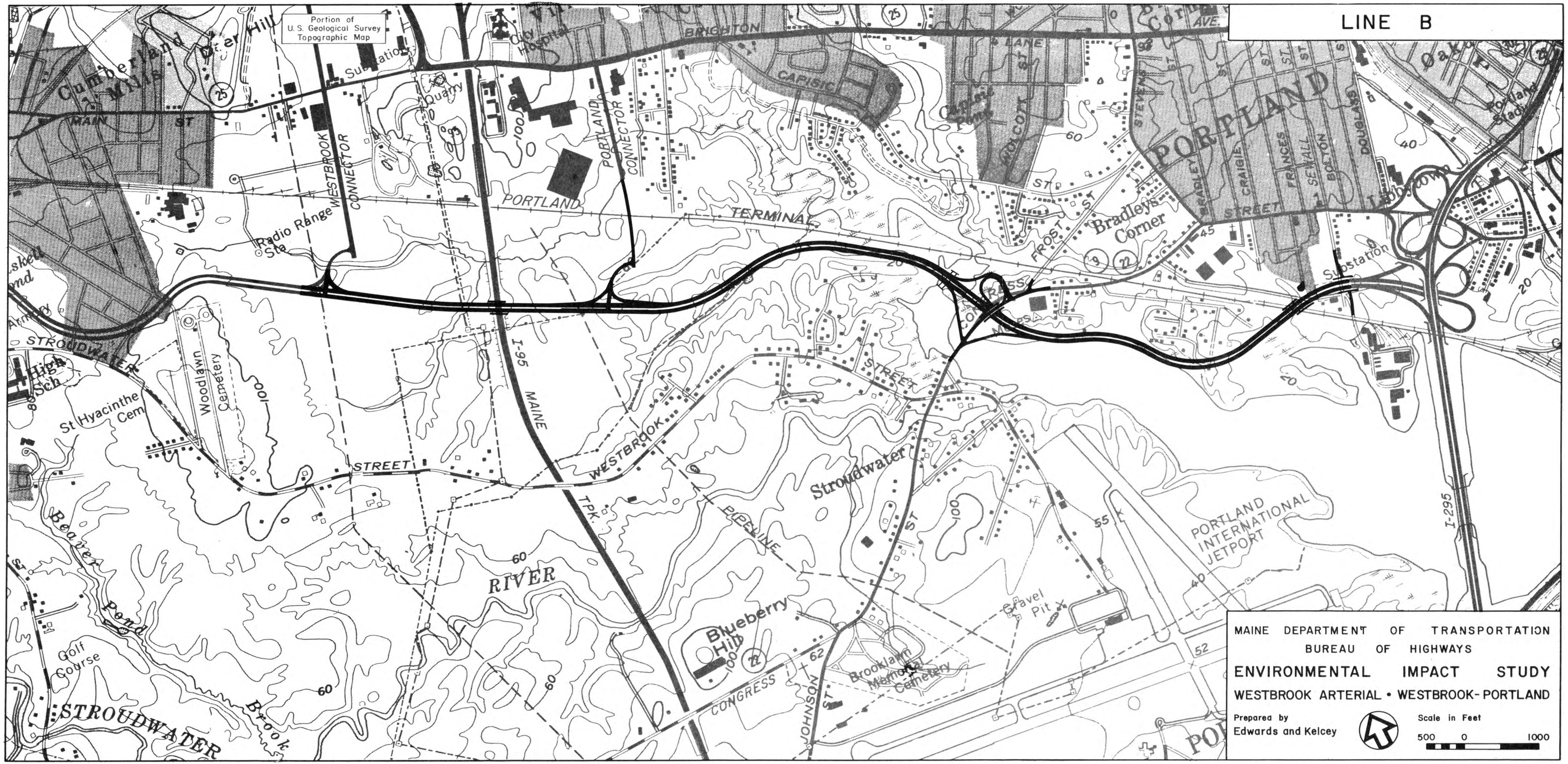
Prepared by
Edwards and Kelcey
Scale in Feet
500 0 1000

FIGURE 3


LINE B
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Topographic Map
MAINE DEPARTMENT OF TRANSPORTATION
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ENVIRONMENTAL IMPACT STUDY
WESTBROOK ARTERIAL • WESTBROOK-PORTLAND
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Edwards and Kelcey
Scale in Feet
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WESTBROOK CONNECTOR
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PIPELINE
Stroudwater
RIVER
Blueberry Hill
JOHNSON ST
Brooklawn Memorial Cemetery
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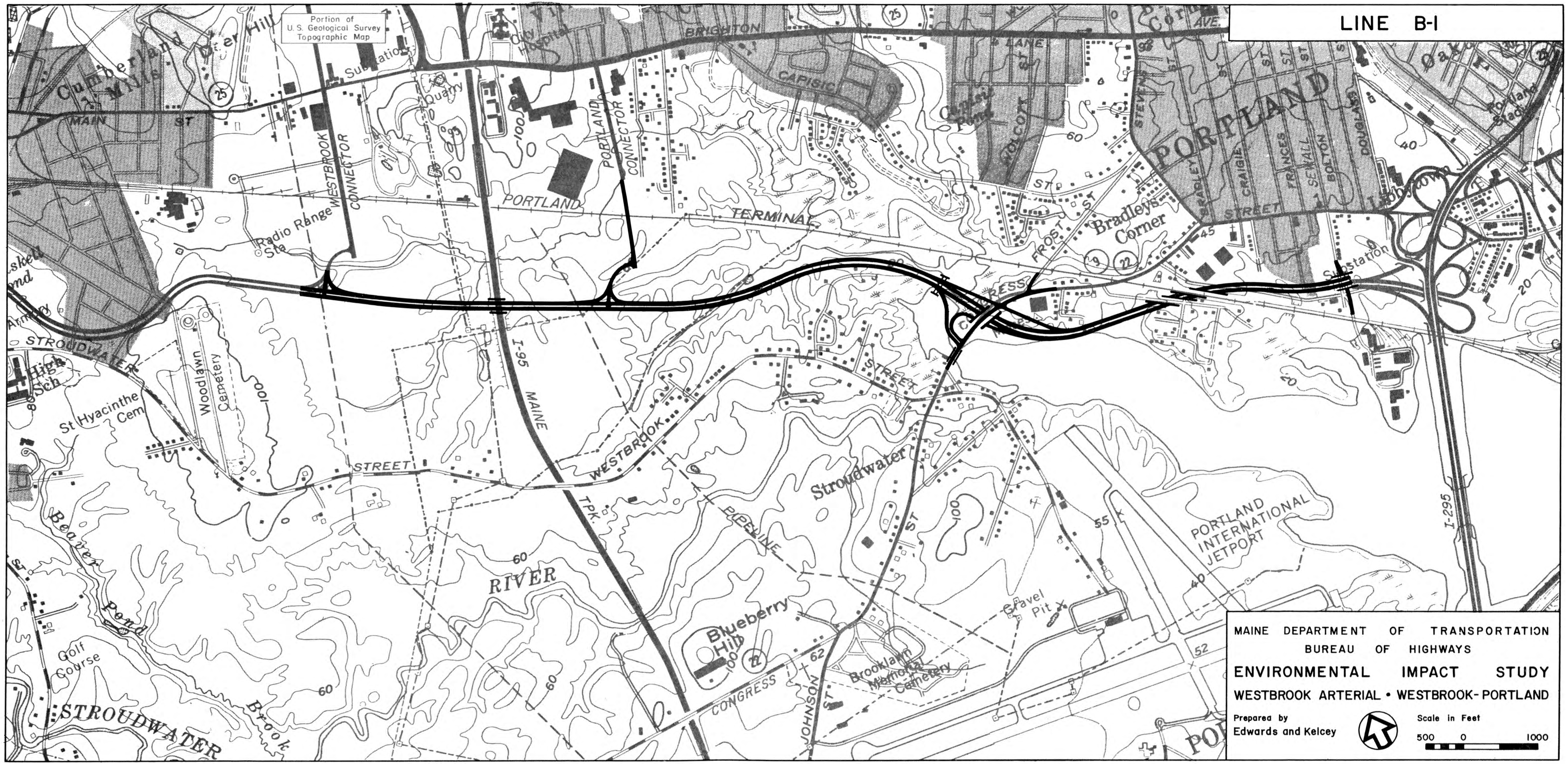
I-295
Golf Course
Beaver Pond
Brook
STROUDWATER
Capisic Pond
STEVENS
BRADLEY
CRAIGIE
FRANCES
SEWALL
BOLTON
DOUGLASS
WOLCOTT
Substation

FIGURE 4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ENVIRONMENTAL IMPACT STUDY
WESTBROOK ARTERIAL • WESTBROOK-PORTLAND
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Scale in Feet
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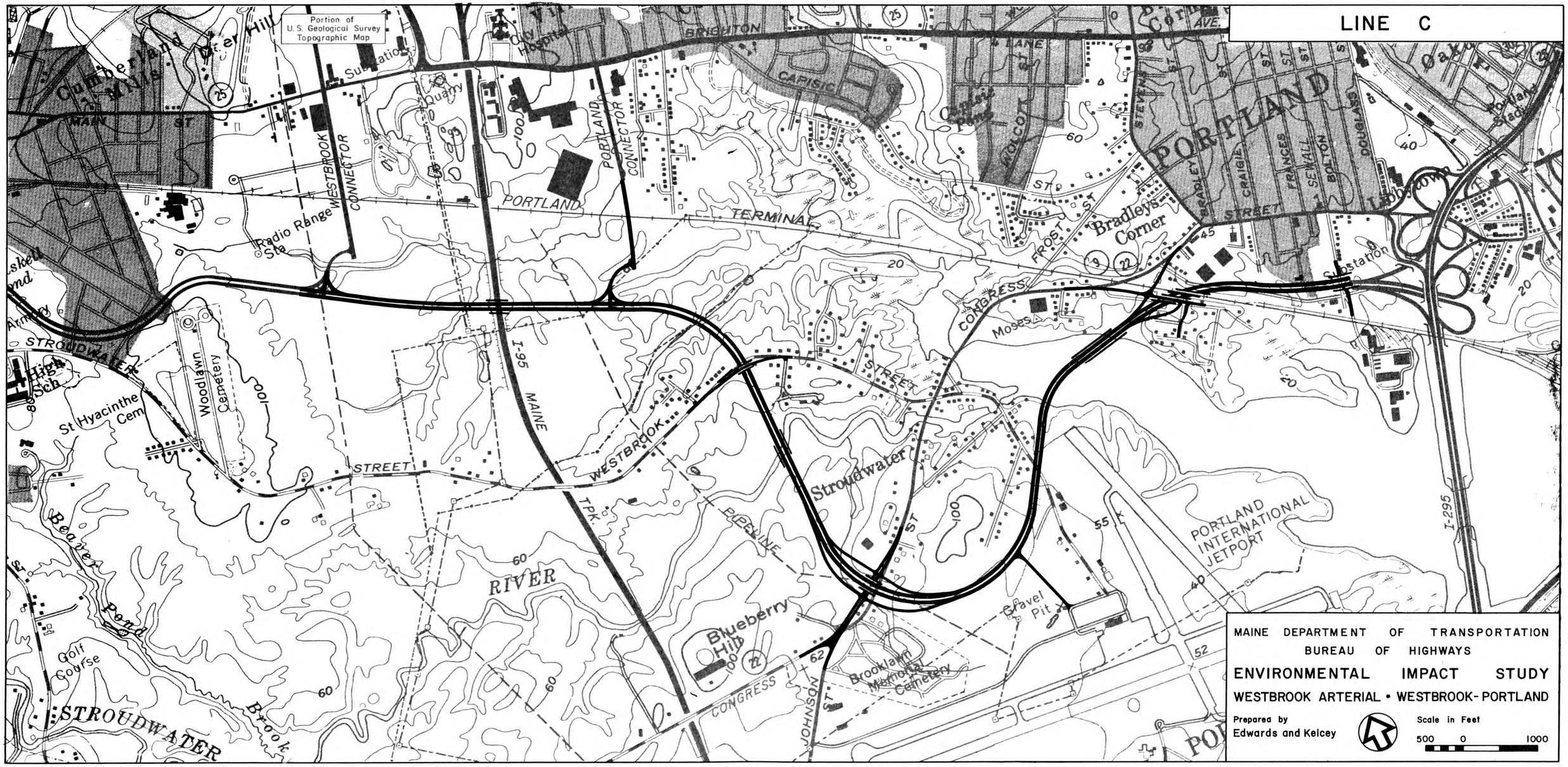
Beaver Pond
Golf Course
STROUDWATER Brook
Blueberry Hill
CONGRESS
JOHNSON ST
Brooklawn Memorial Cemetery
Gravel Pit
PORTLAND INTERNATIONAL JETPORT
I-295
PORTLAND
Bradleys Corner
FROST ST
STEVENS
WOLCOTT
CRAIGIE
FRANCES
SEWALL
BOLTON
DOUGLASS
BRADLEY
Libbytown
Portland Stadium
Substation

FIGURE 5


LINE C
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Cumberland Center Hill
MAIN ST
Sub Station
Quarry
City Hospital
BRIGHTON
CAPISIC
WESTBROOK CONNECTOR
PORTLAND CONNECTOR
PORTLAND TERMINAL
Radio Range Sta
Capisic Pond
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LANE
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FROST ST
Bradleys Corner
PORTLAND
BRADLEY STREET
CRAIGIE
FRANCES
SEWALL
BOLTON
DOUGLASS
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Gravel Pit
Beaver Pond
Golf Course
RIVER
Blueberry Hill
Brooklawn Memorial Cemetery
JOHNSON ST
CONGRESS
STROUDWATER Brook
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Scale in Feet
500 0 1000

FIGURE 6

2. Traffic Volumes

Traffic data employed in the study were supplied by the Maine Department of Transportation, Bureau of Planning. The annual average daily traffic (AADT) volumes for 1974 and 1994 are shown on Figure 7 for the Do-Nothing alternative and on Figures 8 through 11 for Lines A, B, B-1 and C. Design hourly volumes (DHV) on the proposed Arterial would be 10% of AADT; trucks are projected to be 6% of AADT and 5% of DHV. Design hourly volumes on Brighton Avenue are 8.5% of AADT; trucks are estimated to be 5% of both AADT and DHV.

In addition to providing relief to Brighton Avenue and Westbrook Street (the two east-west roadways in the corridor), construction of the Westbrook Arterial will have an effect on other existing roadways in the study area. The effect of the individual alternates varies, as the data in Table 1 indicate.

Comparison of traffic projections shows that the more northerly alinement, Line A, would have the highest daily traffic volumes on the Arterial; Lines B and B-1 would have somewhat less traffic, and Line C, the most southerly routing, would carry the lowest traffic volumes. Each of the alternate alinements would result in a corresponding reduction in traffic on Brighton Avenue west of Stevens Avenue; Line A being the most effective in this respect; and Line C the least effective. Lines A, B and B-1 would have a significant effect on Brighton Avenue traffic volumes east of Stevens Avenue, reducing traffic by approximately 15% in 1974 and 9% by 1994.

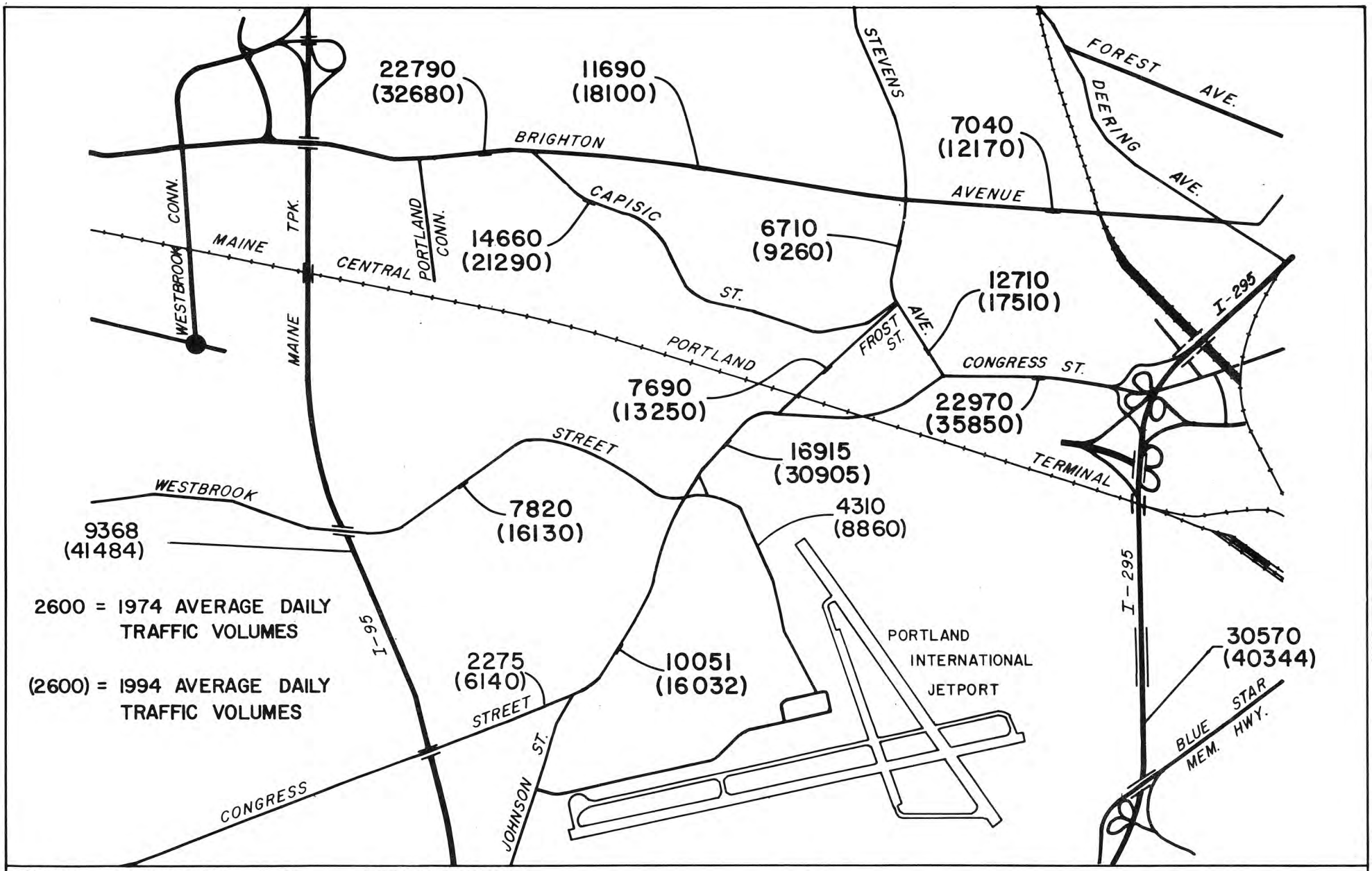
All of the alternates would substantially reduce traffic on Westbrook Street (west of Congress Street) and on Capisic Street. The effect on other existing streets varies wth each alternate alinement. Generally, all the remaining existing streets will benefit from construction of the Arterial; however, Lines A, B, and B-1 would cause a slight increase in traffic on Stevens Avenue between Brighton Avenue and Capisic Street. Line A would significantly increase traffic on Stevens Avenue between Capisic Street and Congress Street because of the dead-ending of Frost Street. Line C would increase traffic on Congress Street in the vicinity of Brooklawn Memorial Cemetery, just south of the proposed interchange; however, traffic on Congress Street north of the interchange and west of the Johnson Street intersection would be substantially reduced.

Table 1

TRAFFIC VOLUMES ON CORRIDOR STREETS*

Street (Location)	Do-Nothing 1974 (1994)	Line A 1974 (1994)	Lines B, B-1 1974 (1994)	Line C 1974 (1994)
Brighton Avenue (East of Portland Connector)	22,790 (32,680)	10,970 (14,760)	13,170 (16,975)	18,580 (24,740)
Brighton Avenue (East of Capisic Street)	11,690 (18,100)	7,330 (10,860)	8,480 (12,740)	11,030 (17,160)
Brighton Avenue (East of Stevens Avenue)	7,040 (12,170)	5,920 (11,000)	6,010 (11,130)	7,290 (12,550)
Capisic Street (Brighton Avenue to Frost Street)	14,660 (21,290)	7,190 (10,450)	8,250 (10,770)	11,100 (14,120)
Congress Street (West of Johnson Street)	2,275 (6,140)	1,295 (3,790)	1,160 (3,140)	990 (2,180)
Congress Street (At Fore River)	16,915 (30,915)	10,770 (21,410)	13,340 (23,450)	4,150 (7,110)
Congress Street (East of Stevens Avenue)	22,970 (35,850)	16,240 (21,150)	11,440 (20,330)	13,800 (18,540)
Frost Street (Capisic Street to Congress Street)	7,690 (13,250)	----- -----	6,370 (11,110)	4,090 (6,970)
Stevens Avenue (North of Capisic Street)	6,710 (9,260)	7,790 (10,180)	6,680 (10,400)	5,080 (7,400)
Stevens Avenue (South of Capisic Street)	12,710 (17,510)	14,090 (23,900)	7,710 (10,350)	10,790 (14,390)
Westbrook Street (West of Congress Street)	7,820 (16,130)	960 (1,630)	960 (1,630	960 (1,630)
Westbrook Street (East of Waldo Street)	4,310 (8,860)	4,310 (8,860)	4,310 (8,860)	1,000 (1,000)

* Numbers shown are projected annual average daily traffic volumes.



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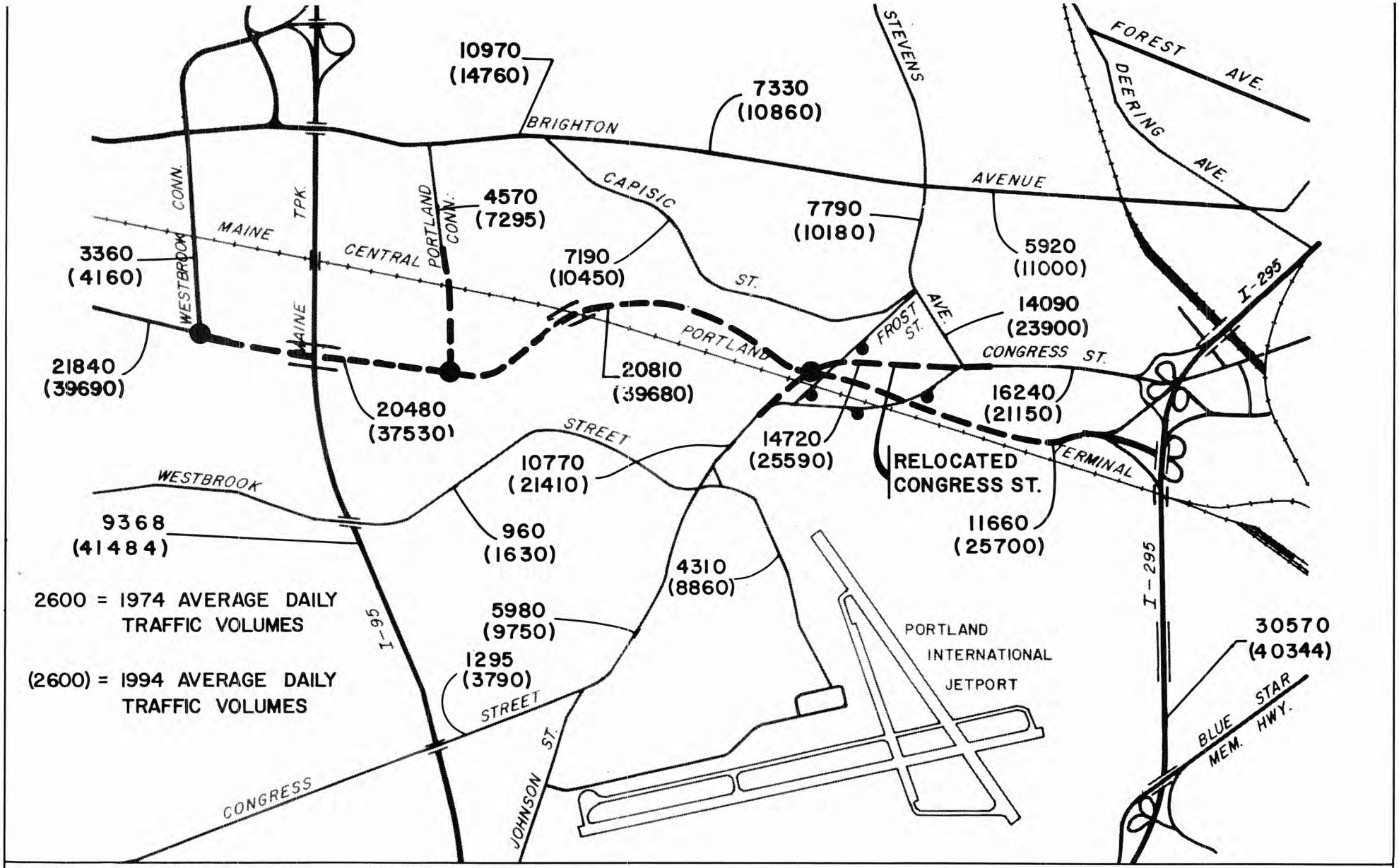
Edwards and Kelcey

TRAFFIC VOLUMES
"DO-NOTHING"

FIGURE 7



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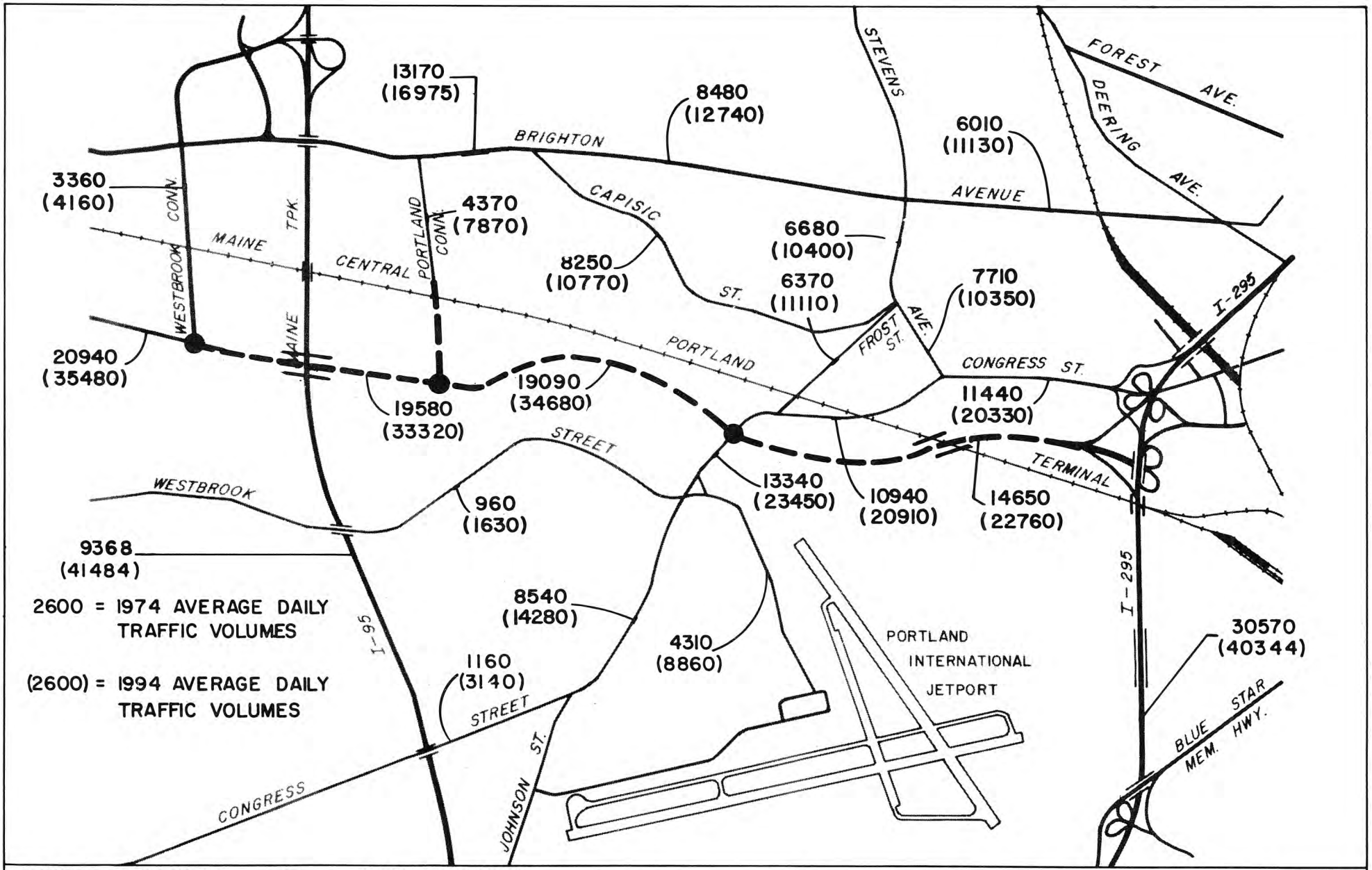
TRAFFIC VOLUMES
LINE A

FIGURE 8



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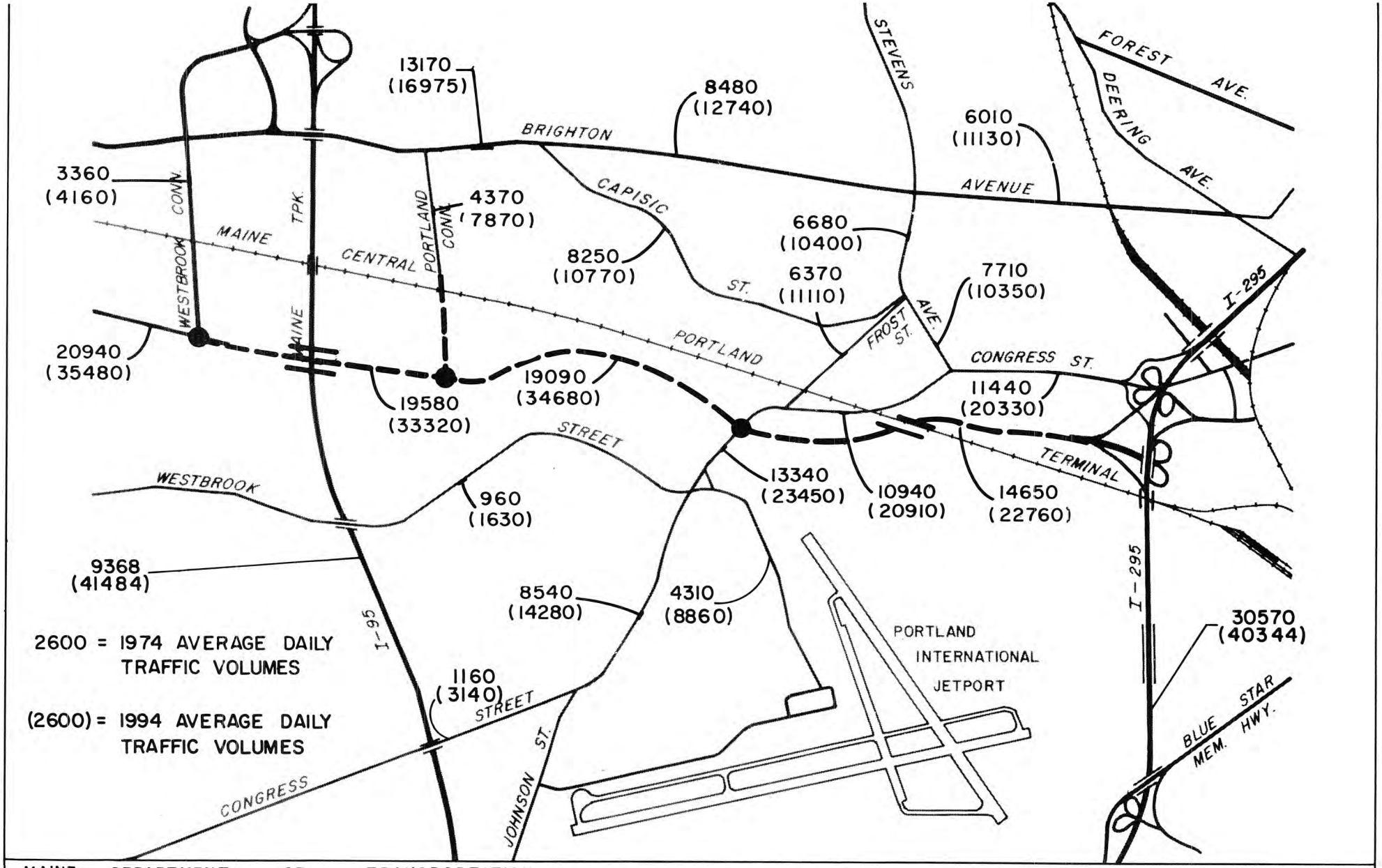
TRAFFIC VOLUMES
LINE B

FIGURE 9



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ENVIRONMENTAL IMPACT STUDY
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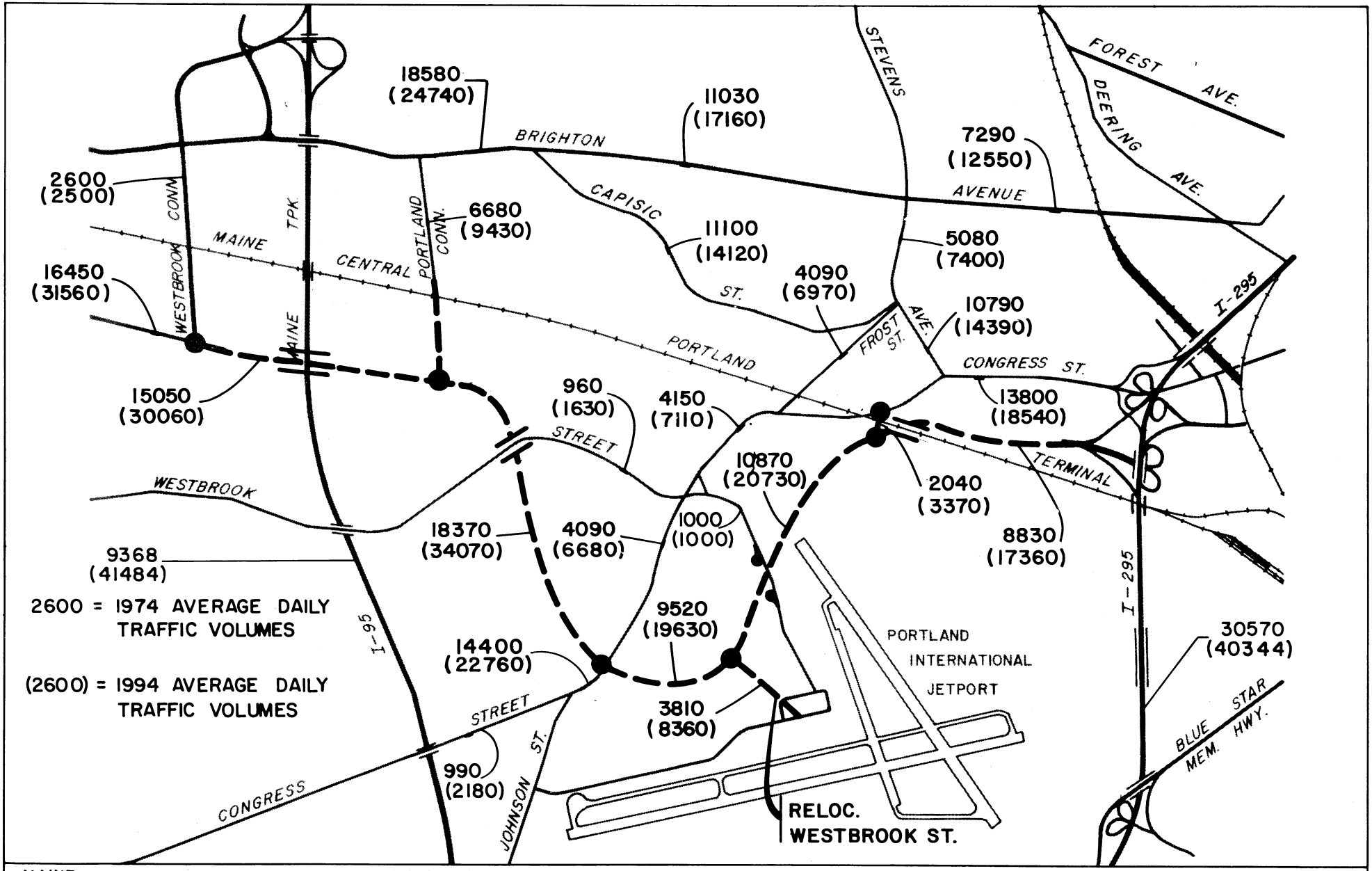
Edwards and Kelcey

TRAFFIC VOLUMES
LINE B-1

FIGURE 10



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TRAFFIC VOLUMES
LINE C

FIGURE 11

3. Costs

The estimated costs for each alternate, based on Spring of 1974 price levels, are shown in the following table.

Table 2

ESTIMATED TOTAL COSTS

Alternate	Total	Construction	Right-of-Way	Utilities	Signing and Lighting
A	$13,402,000	$10,320,000	$2,210,000	$ 722,000	$150,000
B	10,940,000	9,200,000	520,000	1,070,000	150,000
B-1	11,660,000	9,520,000	820,000	1,170,000	150,000
C	18,380,000	16,220,000	1,060,000	875,000	225,000

4. Benefit-Cost Factors

Benefit-cost analyses have been made to compare each alternate alinement of the Westbrook Arterial (Lines A, B, B-1 and C) with the existing roadway network on a basis of road user costs and road user benefits. Each of the alternate networks was compared to the existing system separately to determine a benefit-cost ratio for each system; however, due to their similarity, Lines B and B-1 were not evaluated separately.

In the computation of benefit-cost ratios consideration was given to annual capital recovery costs, maintenance costs, and road user savings in terms of motor vehicle operating costs and the value of time saved. The benefit-cost ratio calculations were conservative in that no increase in travel time was assigned to the existing system assuming no improvements, even though congestion and the increased delays would result in increased driving costs.

Table 3 summarizes the results of the analysis for each of the alinements for the year 1994. The benefit-cost factor expressed in this table is the ratio of each alinement to that obtained for Lines B and B-1. These results indicate that the benefits to be derived by construction of Line B or B-1 will be significantly greater than those obtained through the construction of either Line A or Line C.

Table 3

COMPARATIVE RESULTS OF BENEFIT-COST ANALYSIS

Alinement	Benefit-Cost Factor (Relative to Lines B, B-1)
Line A	0.74
Line B, B-1	1.00
Line C	0.11

C. THE MAN-MADE ENVIRONMENT

1. Socioeconomic Factors

a. Population

According to the city of Portland 1970 U.S. Census, Portland had a population of 65,116 people living within the city limits. This figure represents a population decline of 10.3% from the 1960 population of 72,566 residents. While this is a significant reduction for the city, the remainder of the Portland Standard Metropolitan Statistical Area (SMSA), which includes the cities of South Portland and Westbrook and the towns of Cape Elizabeth, Cumberland, Falmouth, Gorham, Scarborough, and Yarmouth shows a 15% increase in population to 76,509 during the same period. September 1, 1973 estimates made by the U.S. Department of Housing and Urban Development (HUD) (Analysis of the Portland, Maine, Housing Market of September 1, 1971) for population in Portland reflect a further decline to a level of 62,475 or a 13.9% loss from the 1960 figure. While Portland loses population the remainder of the SMSA continues to show an increase to 79,875 people or a 20% growth over the 1960 level.

The major reason for the decline in population in the city is the movement of residents, many of whom are in the childbearing age classes, from the urban environs to the more rural suburbs of the SMSA. This trend is not unique to Portland and can be seen in statistical data for many cities across the country.

b. Employment and Income

The Portland SMSA data for 1970 indicate an annual average employment of almost 64,900 jobs. According to the HUD report previously cited, employment in the Portland SMSA has increased significantly since 1964 in the non-manufacturing areas of trade, services, government, and finance, causing the unemployment rate to drop from 4.6% in 1964 to 2.6% in 1968. However, employment in manufacturing-related fields has been reduced and is expected to decline at a rate of 200 jobs annually, primarily in the food, leather, lumber, and metal industries. The HUD report predicted that non-manufacturing jobs would increase during the period of September, 1971, to September, 1973, by an annual rate of 1,350, which would help to offset the loss of jobs in the manufacturing fields.

In the city of Portland there were 25,775 people employed in 1970 and the breakdown according to industry is shown in Table 4.

Table 4

EMPLOYMENT BY INDUSTRY

Industry	No. Employed	Industry	No. Employed
Construction	1,228	Business and Repair Services	710
Manufacturing	4,345	Personal Services	1,604
Durable Goods	1,821	Health Services	1,943
Transportation	1,180	Educational Services	1,816
Communications, Utilities and Sanitary Services	968	Other Professional and Related Services	1,186
Wholesale Trade	2,149	Public Administration	1,388
Retail Trade	4,923	Other Industries	358
		Finance, Insurance and Real Estate	1,977

SOURCE: Census Tracts, Portland, Maine (SMSA). U.S. Dept. of Commerce, 1970.

The median family income in the Portland SMSA in 1970 was $9,532, while in the city of Portland the median family income was $8,456. There were 1,696 families below the poverty level, which represents 10.7% of all families in the city.

c. Housing Characteristics

In the Portland SMSA there were 50,168 total housing units; of these, 1,914 were seasonal in nature. In the city of Portland there were 25,393 total housing units and of these, 1,082 were seasonal in nature. These units break down as indicated in Table 5.

Table 5

HOUSING UNITS IN PORTLAND SMSA

	City of Portland	Balance of SMSA	Total SMSA
Owner Occupied	10,062	17,509	27,571
Median price asked	$16,500	$18,100	$17,600
Renter Occupied	12,718	5,223	17,941
Median rent asked	$ 81	$ 121	$ 85

Property values of specified owner occupied units in Portland SMSA are distributed as in Table 6.

Table 6

DISTRIBUTION OF PROPERTY VALUES OF OWNER OCCUPIED UNITS FOR PORTLAND SMSA*

	$ 0 4,999	$5,000 9,999	$10,000 14,999	$15,000 19,999	$20,000 24,999	$25,000 34,999	$35,000 49,999	$50,000 59,999+
Cape Elizabeth	6	38	292	382	369	500	262	109
Cumberland	31	71	121	217	138	158	86	74
Falmouth	20	82	241	374	300	245	106	96
Gorham	49	171	274	348	180	88	27	4
Portland	130	777	2093	2686	1165	689	216	84
Scar-borough	52	205	394	467	199	107	45	15
South Portland	45	413	1837	1467	497	197	47	23
Westbrook	27	185	825	852	332	106	22	3
Yarmouth	10	62	171	250	142	115	65	26

* Limited to one-family homes on less than then acres and no business on property.

SOURCE: Statistical Abstract: Cumberland Planning & Development District, 1972.

Table 7 shows values for specified renter occupied units.

Table 7

NUMBER OF RENTED UNITS BY MONTHLY RENT*

	City of Portland	Balance of SMSA	Total
Less than $30	244	110	354
$30-$39	455	134	589
$40-$59	2,363	745	3,108
$60-$79	3,272	1,598	4,870
$80-$99	2,691	803	3,494
$100-$149	2,721	987	3,708
$150-$199	383	253	636
$200-$249	102	51	153
$250+	90	43	133
No cash rent	360	350	710

* Excludes one-family homes on 10 acres or more.

The amount of general housing stock for the city of Portland was in serious decline during the period 1960-1970. There was a net loss of 902 units due to the various projects of the Portland Renewal Authority, Maine State Highway Commission, University of Maine at Portland and the City of Portland. During the 1960's these projects eliminated over 1,200 housing units, replacing only 386 with public or subsidized housing. The trend has been dramatically reversed since 1970 with the net gain of 731 new housing units. The major portion of these new units is the result of the construction of 522 subsidized units under the FHA 221-D3 and 236 programs. New single-family construction is also responsible for a portion of the increase while private development of multi-family units added little.

d. Neighborhood Characteristics

The neighborhoods (Figure 12 on page 41) of the city of Portland which are included in or border the study area are Nasons Corner, Deering Center, Oakdale, Rosemont and Stroudwater. A general description including population, growth and economic characteristics for each of these neighborhoods is included below. The information presented is from the Inventory of Housing, Neighborhood Analysis and Housing Forecast prepared by the City Planning Department, Portland, Maine, in March 1973.

Nasons Corner - This neighborhood is located in the west central part of Portland and in the northwest portion of the study area. Comprising an area of approximately 807 acres, Nasons Corner is bounded by Evergreen Cemetery - Warren Avenue, the Westbrook City Line, the Portland Terminal rail line right-of-way and Capisic Pond - Wayside Road.

The neighborhood is developed as a primarily single-family residential area with only 177 acres of vacant land, of which 136 acres are zoned for residential use. Sewers serve 75% of the neighborhood with the non-sewered areas abutting the Portland Terminal right-of-way and the land between Taft and Norwich streets. The lack of sewers and the presence of two below par subdivisions represent the limiting factors to development of the remaining land.

An established neighborhood, Nasons Corner had a population of 4,421 residents in 1970. This is a 40.6% increase over the 1960 population of 3,144 people. The age distribution for this neighborhood reflects a 40% increase in the age group below 5-19, a 12% increase in group 20-34, a 42% increase in group 35-59 and a 27% increase for 60+. The smaller increase in ages 20-34 most likely indicates the difficulty encountered by some members of this age group in purchasing the higher priced homes of this area.

There were 1,259 housing units in this neighborhood in 1972. Of this group 98.5% were classed as standard, 1.5% as deficient and none classed as substandard. A total of 75% of the available units were owner-occupied. Of the 315 multifamily units in Nasons Corner, 200 are public housing in Sagamore Village. No new multi-family dwellings have been constructed since 1970, however, 48

new single-family homes have been built during this period. The median value of owner-occupied houses was $19,000 in 1970, and the median contract rent for rental units was $63 per month.

Median family income for Nasons Corner ranks third in the city, at $10,270. There were 87 families in the neighborhood below the poverty level and 89 families receiving some form of public assistance. These families represent 8.6% of the families in the neighborhood and are primarily found in the low income housing in Sagamore Village.

The labor force of 1,481 workers in Nasons Corner is primarily involved in sales and professional occupations. Important employment centers are the Pine Tree Shopping Plaza and the commercially developed area around Exit 8 of the Maine Turnpike. The labor force is generally employed outside of these neighborhood centers and use the automobile as the major means of transportation to and from work.

There are no parks, one playground, and a single public social facility--the Resource Center--serving the Nasons Corner residents. Portland City Hospital is located here, but is available primarily to low income and elderly citizens and does not provide health care to the majority of residents who live here. A fire station located in the Rosemont section of Portland also covers Nasons Corner. The built-up areas of Nasons Corner are within 1.5 miles of this facility, and access is generally along Brighton Avenue.

Of the 1,410 students living in Nasons Corner, 1,317 attend public schools. The junior high students attend Lincoln Junior High, while high school students go to Deering High. Both schools are located in Deering Center. Hall Elementary School serves the area. It was built in 1959 and has a capacity of 800 with 759 attending in 1972.

Two minor arterial streets pass through the Nasons Corner neighborhood. These are Brighton Avenue with a daily volume of about 20,000 and Riverside Avenue with a daily volume of about 10,000 vehicles. The streets in the area are in generally good condition although there is a decided lack of sidewalks serving pedestrian traffic. Although the primary means of transportation for people of this neighborhood is the automobile, there are two bus lines serving the residents. These lines are the Westbrook line and the Brighton Avenue line, each having headway times of 20-30 minutes during the day and 40-50 minutes at night.

Deering Center - Located in the west central portion of Portland and east of Nasons Corner, Deering Center is an established residential area of 444 acres, bounded by the Maine Central Railway, Walton Street, Stevens Avenue, Evergreen Cemetery, Wayside Road, Woodford Street and a portion of Brighton Avenue. The land use is primarily single-family residential at the western edge of the neighborhood, with multi-family occupying the remaining residential portions. Commercial zones exist along Forest Avenue at Highland and Woodford Streets and Stevens Avenue at Pleasant Avenue. Only 19 acres of vacant land presently

exist in this neighborhood and this single parcel is scheduled for a residential subdivision which will encompass the total area. Sewers serve the entire site but are adequate in only the eastern portion.

A 1970 population of 4,173 residents reflects a 10.6% decrease from 1960 levels of 4,649. The age distribution for this neighborhood shows a 15% decrease in age groups below 5-19, a 62% increase in age group 20-34, a 20% decrease from 35-59 and a 2% increase for 60+. These changes indicate that the more established and financially stable families with children have moved out while younger couples and students at University of Maine at Portland, just starting out and probably less well financed, are living here. A closer look at the age group 20-34 reflects this as one sees a 51.0% increase in residents from 20-24 and a 7% decrease in the 25-34 age class. The increase of 2% in the age class over 60 is a result of the addition of 200 units of elderly housing financed under the Federal Housing Authority (FHA) 236 program and administered by the Portland Housing Authority.

The Deering Center housing stock consists of 1,623 units, 91.1% of which are classed as standard, 8.7% deficient and 0.2% substandard. Owners occupy 55% of the housing units and the median value of these units is $17,300. The median contract rent for rental units is $93 per month. The majority of the 204 multi-family units in Deering Center are FHA 236 elderly housing units with only four units in private ownership. All multi-family units have been constructed since 1970.

The median income of families in Deering Center is above the city average and the number of families below the poverty level, or receiving some type of public assistance, is well below the city average.

There are no major employment centers in the Deering Center neighborhood. The area does contribute 1,684 persons to the labor force, mostly in the fields of sales and professional (including self-employed) endeavors.

There are two large parks, Baxter Woods and Presumpscot Park/Baxter Pines, in Deering Center, but the only social facilities open to the public are located within the schools and generally geared toward student activities.

Health services are provided to the neighborhood by the three non-profit association (NPA) hospitals in the City (Mercy, Maine Medical Center and Maine Osteopathic). There are two fire stations located within 0.5 mile of any portion of the neighborhood although neither is located in the neighborhood.

Three schools, Deering High, Lincoln Junior High, and Longfellow Elementary are located in Deering Center. Of the 1,049 students, 990 are in the public school system. A severe problem of overcrowding exists in these schools and a School Needs Study, by the Portland School Committee and Portland Planning Board, is under way to assess this problem.

Forest Avenue, a major arterial, and Stevens and Woodford streets, minor arterials, represent the significant traffic corridors in Deering Center with

daily volumes of about 20,000, 10,000 and 5,000, respectively. The streets of Deering Center are generally classed as fair with some having received recent work and some needing repair or rebuilding. Sidewalks are in a condition similar to the streets, and lack of off-street parking poses a problem in areas of concentrated multi-family residences.

Three bus lines (Westbrook line, Prides Corner line and North Deering-Stevens Avenue line) serve the neighborhood. These lines provide primary transportation for approximately 10% of the residents and are within walking distance of the entire Deering Center neighborhood. The majority of residents use private transportation to commute to work.

Oakdale - The smallest neighborhood (306 acres) in the city of Portland, Oakdale is a mature section bounded by Deering Oaks, Back Cove, Ashmont and Belmont streets, and the Maine Central Railroad. The area is primarily residential with the area south of Brighton Avenue zoned as single-family and north of Brighton Avenue multi-family. This land use is heavily influenced by the construction of I-295, commercial encroachment from the strip along Forest Avenue and by the University of Maine at Portland. There are no areas of developable size left in this neighborhood. The area is served by city sewers in good condition.

Population trends show a decrease of 23% from 1960 (4,409) to 1970 (3,385). All age classes except the 20-24 and 75+ age groups show decreases. A 6.6% increase for the 20-24 age grouping is more than likely due to students attending the University of Maine at Portland seeking housing in this neighborhood while the 21.6% increase in the 75+ group is due to the close proximity of services in the downtown area.

Population decline is partially a result of the demolition of housing structures by I-295 construction and the movement of people to the more rural parts of the city and surrounding suburbs.

Oakdale has 1,314 dwelling units, of which 92.9% are classed as standard, 7.1% deficient and none as substandard. Owners occupy 42% of the existing units which had a median value of $19,100 per unit in 1970. The remaining units are rental dwellings which have a median contract rent of $68 per month.

The Oakdale neighborhood has experienced a significant housing loss since 1960 due to the construction of I-295 and the expansion of the University of Maine at Portland. The total loss during this time was 299 units with only eight units added. There has been very little new construction involving dwelling units in Oakdale, and very little land is available for this purpose. It has been stated by the University of Maine at Portland that very little further expansion of their facilities is anticipated in this neighborhood. The Department of Transportation has indicated a similar policy with regard to their own projects. It would seem, therefore, that the housing stock here is stable, and only improvement of the existing facilities would be feasible.

The median family income for Oakdale is $7,645 which is below the city median and is classed as low-middle income. There were 103 families below the poverty

level which is almost equal to the city average. The number of families receiving some form of public assistance is 41 or 4.1% of the total in the neighborhood. This level is less than the city-wide rate of 7.5%.

The major employment centers in Oakdale are the University of Maine at Portland, Oakhurst Dairy and the commercial establishments along Forest Avenue. The area contributes 1,099 people to the total work force. The majority (80%) use their automobiles to travel to work, which indicates that they are not employed in the neighborhood employment centers. The majority of the employed people work in sales or professional fields.

Although Oakdale has only three small (less than one acre) parks within its boundaries, it is adjacent to the Deering Oaks Park which is the largest activity-oriented park in the city. It is also just to the east of Dougherty Field, which has a public swimming pool, playground, ball field and tennis courts. The area has no public social facilities and its health needs are served by the three NPA hospitals in the city.

Fire protection is provided by two stations. The Bramhall station covers the area east of Woodmont Street while Roosevelt station covers the rest of the neighborhood. All areas of Oakdale are within a one-mile radius of one or the other station. The Central Police Station is located at Franklin and Middle Streets.

Two schools, Clifford Elementary and King Junior High are located in and serve the Oakdale neighborhood. The high schools students are served by Portland and Deering High Schools. There are 531 students in Oakdale attending public schools. King Junior High is in an overcrowded condition and solutions to this problem are to be promulgated in the School Needs Study.

Arterials in the Oakdale neighborhood are Forest Avenue (major), Brighton Avenue (minor), Deering Avenue (minor) and Baxter Boulevard (minor). The approximate daily traffic volumes for these arterials are 20,000, 15,000, 10,000, and 10,000, respectively. Bedford Street and Dartmouth Street are classed as collector streets and have volumes of 5,000 each.

Streets range in condition from fair to good and the area has sidewalks on 90% of the streets. Lack of off-street parking is a problem near rental areas and as the University of Maine at Portland expands its student and faculty populations this problem will increase.

Public transportation is provided by the Brighton Avenue and Forest Avenue bus lines. Approximately 10% of the working residents use these lines as their primary transportation.

Rosemont - Occupying 959 acres in the south central portion of the city of Portland, Rosemont is bounded by the Maine Central Railroad right-of-way, the Fore River, Capisic Pond, Brighton Avenue and Woodford Street. Land use in the Rosemont section of Portland is mixed with residential classes being the most prominant. Single-family use occurs west of Edwards Street and north of Congress Street while multi-family uses are confined primarily to the southern

and eastern areas of the neighborhood. The major industrial uses are located in the Thompson's Point area. There are 120 acres of open land available in the neighborhood but only 104 of these are developable with only 27 of these acres designated for residential use. The remaining 77 acres are primarily zoned for industrial uses. Large portions of the land south of Congress Street and bordering the Fore River are slated for industrial development while commercial uses are quite common in the strip along Congress Street and Brighton Avenue.

Much of the area is served with city sewers in good condition. There is a small portion between Congress Street and the Portland Terminal rail line which is not provided with city sewer service.

Population trends for Rosemont indicate a pattern very closely allied with the pattern exhibited by the city of Portland in general. An 11% reduction in population from 1960 (8,006) to 1970 (7,113) is reflected in decreases in all age classes except one. The under 5-19 age group shows a 13% decrease, the 20-34 group showing an increase of 9%, the 35-59 group a 23% decrease and the over 60 group a decrease of 2%.

Upon close examination of these groups one sees that the real increase has occurred between 15-19 (12.3%) and 20-24 (58.1%) with a decrease in class 25-34 (11.1%). This again indicates that the area is used by young people either just starting out and unable to finance a single-family home, or by students at the university. High numbers of rental units in Rosemont tend to bear this out. The slight decrease in the over 60 age group may indicate a hesitancy to leave the downtown service area and medical complex.

There are 2,314 housing units in the Rosemont neighborhood, of which 97.8% are rated as standard, 2.16% as deficient and .04% as substandard. Owners occupy 66% of these units, which have a median market value of $17,616. Renters occupy 34% of the units and pay a median contract rent of $88 per month.

The effect of I-295 has been obvious on the housing stock available in the Rosemont section. There has been a continual decline in available units, much of which can be attributed to the demolition associated with I-295. This effect is seen most dramatically in the area of Libbytown from St. John Street to the Portland Terminal Line. This portion of the neighborhood is of deteriorating residential value and subtle land use changes are taking place. The stable portion of the neighborhood between Brighton Avenue and Congress Street has seen some new residential construction, and if the units demolished for I-295 are excluded, the housing stock additions exceed losses by a three to two ratio.

The median family income in Rosemont is $10,255 per year, which is well above the city-wide level. In 1960, Rosemont had the highest median income in the city, however, it ranked third in 1970. There are 111 families below the poverty level and 79 families receiving some form of public assistance. These levels of 6% and 4%, respectively, are well below the median levels for the whole city.

Although the Rosemont neighborhood has significant areas of major employment (Thompson's Point, Holmes Stickney Company, Portland Water District, Osteopathic Hospital and the West Gate Shopping Center), most (88%) of the labor force of 2,942 use their automobiles to commute to work which indicates that they are not employed in the immediate area. The predominant occupations are the sales and professional fields.

Dougherty Field provides the only active recreation facilities in Rosemont while Capisic Pond Park provides for passive recreation in a limited fashion.

The medical facilities of the three NPA hospitals in Portland are available to the residents of this neighborhood with some residents located within walking distance of the Maine Osteopathic Hospital.

Fire protection is provided by the Roosevelt Fire Station for most of Rosemont with the Bramhall Station covering the southeastern portion of the neighborhood. Police coverage is from the Central Police Station.

Two elementary schools serve Rosemont. The West School, built in 1962, has a capacity of 425 students while the Roosevelt School, built in 1919, has a capacity of 200 students. Junior high and senior high students must leave the area to attend school. There are 1,668 students in Rosemont, of which 1,412 attend public schools.

Major daily traffic volumes in Rosemont are centered on seven streets. Congress Street (15,000), Brighton Avenue (15,000), Frost Street (5,000), and Stevens Avenue (10,000) are all classed as minor arterials with only Stevens Avenue being in generally poor condition. Capisic Street (5,000), Woodford Street (5,000) and Whitney Street (5,000) are classed as collector streets being in fair to good condition. Hazardous conditions exist at the intersections of Congress Street and Stevens Avenue, Capisic Street and Stevens Avenue, Brighton Avenue at Stevens Avenue, and Stevens Avenue at Woodford Street. Heavy congestion exists on both Congress Street and Brighton Avenue. Sidewalk conditions for the above streets are rated as fair to good with the exception of Stevens Avenue which is classed as poor. Off-street parking presents no problem except in areas where single-family homes have been converted to multi-family dwellings.

The Brighton Avenue and Stroudwater bus lines serve Rosemont but only about 6% of the residents use these lines as primary transportation.

Stroudwater - Bounded by the Portland Terminal rail line, the Portland-Westbrook City Line, the Portland-South Portland City line and the Fore River, the 1,486 acres of Stroudwater are some of the most rural areas of the city. Land use is mixed; however, the area is predominantly zoned and developed as a low density residential area. A small area zoned for multi-family use exists on Congress Street just north of the bridge over the Fore River. Major employment centers exist at Portland International Jetport and Union Mutual Life Insurance Company. Much of the land in Stroudwater is open and undeveloped (54.4%). Of the 809 vacant acres, 688 acres are developable with 280 zoned

for residential use and 408 for non-residential use. The land west of the Maine Turnpike is zoned for industrial development. A major factor that limits the development of land in Stroudwater is the lack of sewers. At present only small portions of Stroudwater are sewered with much of the developed area using individual septic systems. Due to poor soil conditions expansion of the sewage system will be necessary before further development can be realized.

The population of this neighborhood is low and has grown quite slowly. In 1970 there were only 553 people living here, which represented an increase of only 26 people since 1960. This group of people has the highest income level in the city with a median family income of $14,667. There is no indication of people living below the poverty level or of anyone receiving public assistance. The lack of new development, relatively high cost of land and the historic, rural atmosphere have all contributed to this stability.

Of the 197 housing units located in Stroudwater, 169 or 86% are owner-occupied. These units had a median value of $20,300 in 1970 compared to $15,923 in 1960. During the ten-year period the median increase was $6,150. The renter-occupied units have a median contract rent of $70 per month which is a $26 increase from the $44 level of 1960. The housing units are in good condition with 99% being rated as standard and 1.0% rated as deficient. There are no substandard units noted in Stroudwater. The growth in this neighborhood is quite slow with only 50 housing units added between 1960 and 1972.

There were 237 workers in the labor force in 1972 from Stroudwater. The majority (75%) of these workers were employed in the sales and professional occupations. The major employment centers in Stroudwater are Union Mutual Life Insurance Company and the Portland International Jetport, although the majority of Stroudwater wage earners did not work at these centers.

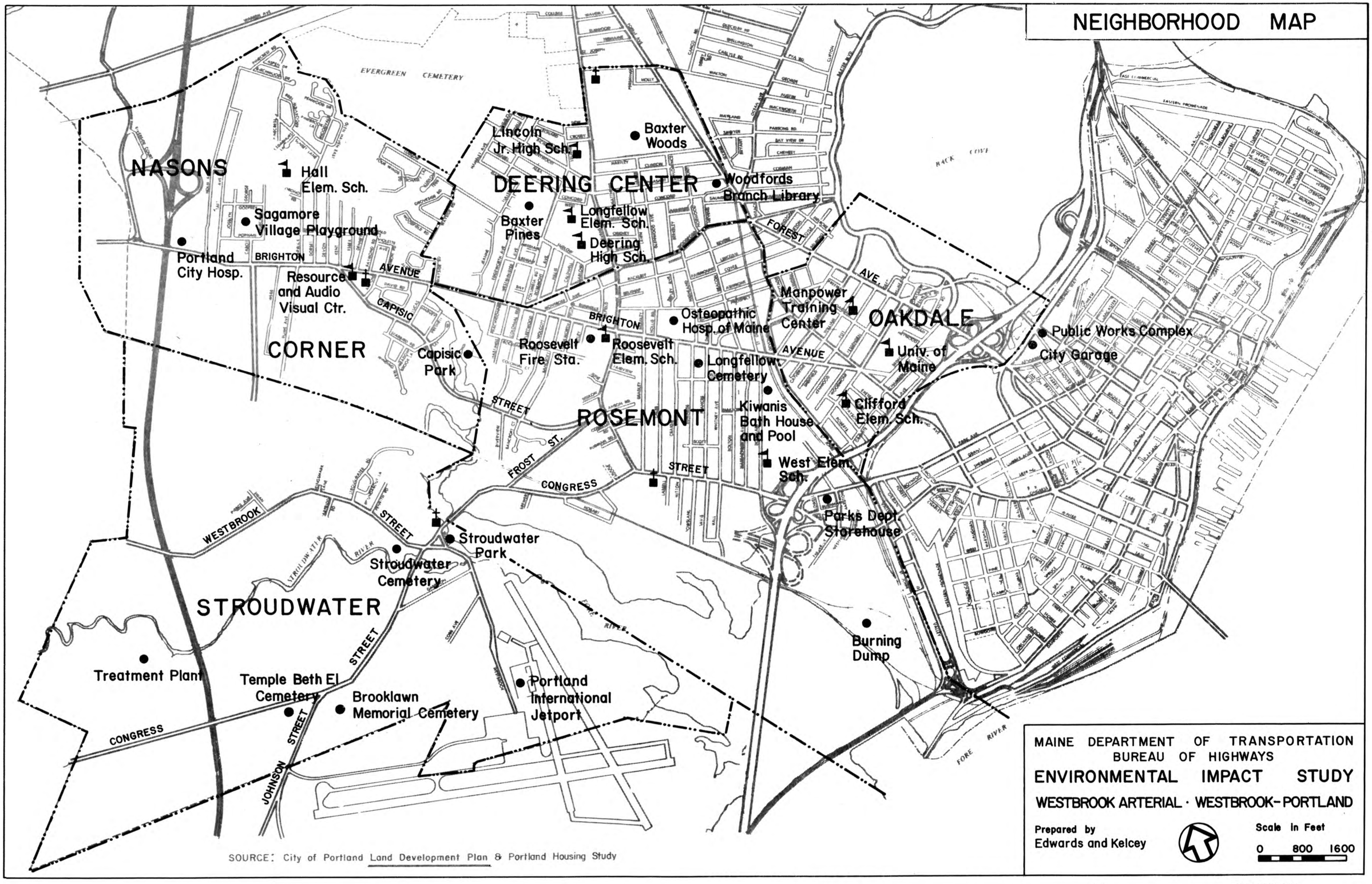
The Stroudwater neighborhood also contains a historic district which has been placed on the National Register of Historic Places. This district encompasses approximately 115 acres of land in the center of the neighborhood and is called Stroudwater Village. Settled in 1727, this historic district contains some thirty houses from the Colonial, Federal and Greek revival periods. Stroudwater Village remains today as a unit representing an important portion of local history. (See section "g", page 46.)

Park land is minimal in the neighborhood with the only public facility being a small parcel known as Stroudwater Park. This lack is more than compensated for by the large amount of open space consisting of both upland and the wetlands of the Fore River. There are no public social, cultural or indoor recreational facilities in Stroudwater.

Health facilities are provided by the three NPA hospitals of Portland, but none of these are within walking distance of the neighborhood.

No fire or police stations are located in Stroudwater and coverage comes from the Rosemont Fire Station and the Central Police Station in Portland.

NEIGHBORHOOD MAP



SOURCE: City of Portland Land Development Plan & Portland Housing Study

MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

ENVIRONMENTAL IMPACT STUDY

WESTBROOK ARTERIAL · WESTBROOK-PORTLAND

Prepared by
Edwards and Kelcey

Scale in Feet
0 800 1600

FIGURE 12

All of the 219 students must leave the Stroudwater neighborhood to attend school since there are no schools located there. There are 178 students in the public school system with the remainder attending private institutions.

Congress Street, a minor arterial (20,000 vehicles per day) and Westbrook Street, a minor arterial (5000 vehicles per day) carry the large portion of traffic through this neighborhood. These two streets are deficient in capacity and require improvement. Congress Street is in fair to good condition, but Westbrook Street is in need of major repair work. There are no sidewalks provided in Stroudwater due to low pedestrian traffic. Off-street parking presents little problem due to the fact that the area is primarily single-family homes. The Stroudwater bus line serves the area, but 94% of the people use the automobile as their primary means of transportation.

e. Land Use

The present general land use of the study area is shown in Figure 13. A major portion of the existing land use is taken up by open space with the Fore River and its associated wetlands being a predominant feature.

Medium residential land use occurs primarily in the more northerly portions of the area while light residential densities occupy the central and southerly portions.

The only public recreational facility is represented by Capisic Pond Park while a Little League Field near Thompson's Point represents a private facility. The Elks Club on Congress Street represents a private institutional land use in a primarily residential zone.

Two cemeteries, Brooklawn Memorial and Temple Beth El, are located to the south at Congress and Johnson streets.

Significant commercial uses occur at the Pine Tree Shopping Plaza at the Portland Connector, at Westgate Shopping Plaza on Congress Street at Stevens Avenue, and at Union Mutual Life Insurance Company, Inc. at lower Congress Street and the Maine Turnpike. Commercial uses are also scattered along Brighton Avenue in the more northerly portion of the area.

Industrial uses occur on Thompson's Point and at an electroplating and printing establishment at Congress and Frost streets.

The Portland International Jetport occupies a dominant position on the south-easterly bank of the Fore River.

Utility lines, both existing and proposed, are shown on Figure 14 and criss-cross the area in many locations with the most observable ones being located in the westerly portion of the open space areas. The Portland Terminal rail line passes through the northcentral portion of the area in an east-west direction.

The Stroudwater River is the most predominant source of fresh water in the area. It is impounded by a dam located just before the river passes under Westbrook Street.

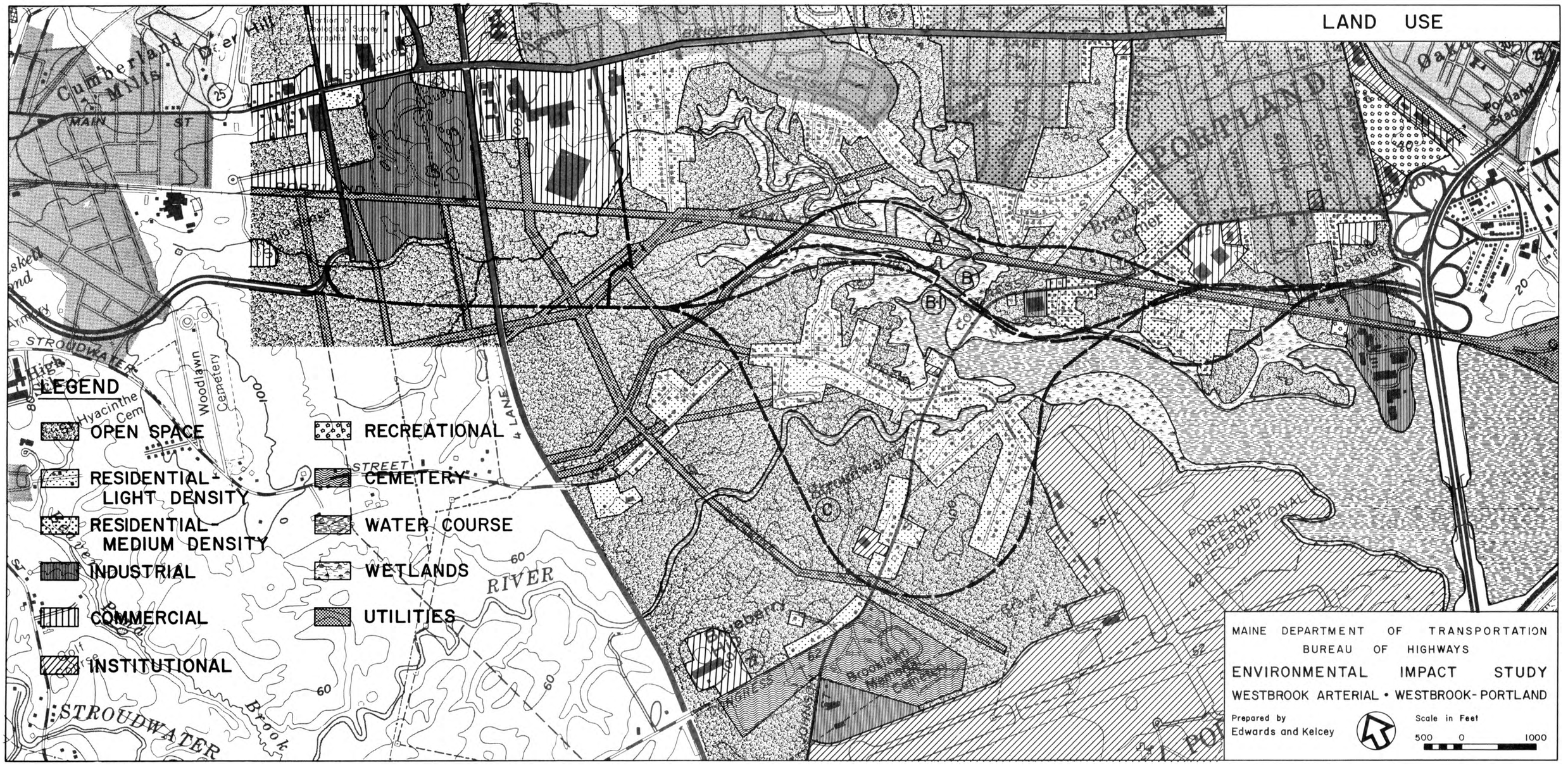
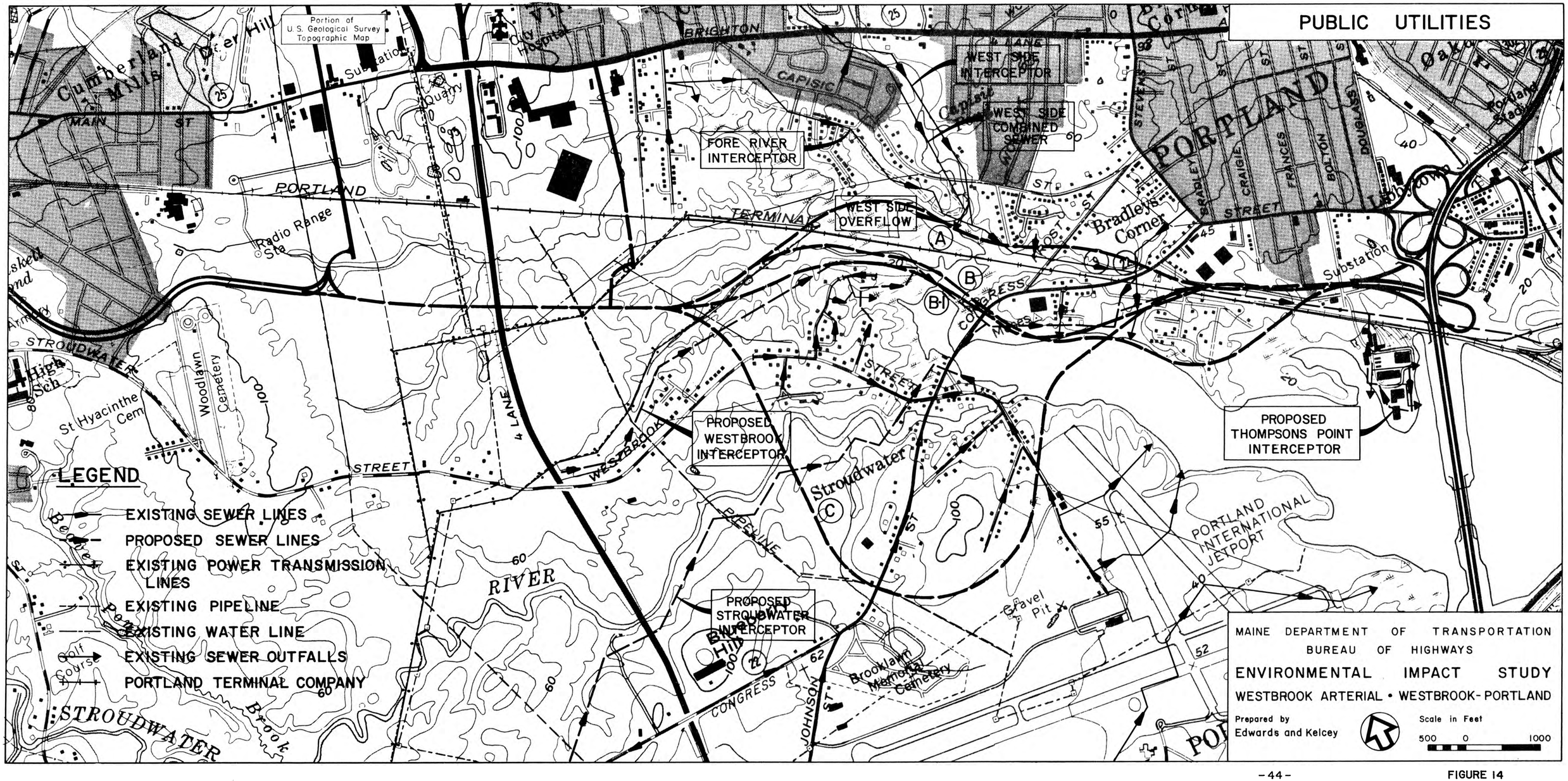

LAND USE
LEGEND
OPEN SPACE
RESIDENTIAL - LIGHT DENSITY
RESIDENTIAL - MEDIUM DENSITY
INDUSTRIAL
COMMERCIAL
INSTITUTIONAL
RECREATIONAL
CEMETERY
WATER COURSE
WETLANDS
UTILITIES
MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS
ENVIRONMENTAL IMPACT STUDY
WESTBROOK ARTERIAL • WESTBROOK-PORTLAND
Prepared by
Edwards and Kelcey
Scale in Feet
500 0 1000

FIGURE 13


PUBLIC UTILITIES
Portion of U.S. Geological Survey Topographic Map
WEST SIDE INTERCEPTOR
WEST SIDE COMBINED SEWER
FORE RIVER INTERCEPTOR
WEST SIDE OVERFLOW
PROPOSED WESTBROOK INTERCEPTOR
PROPOSED STROUDWATER INTERCEPTOR
PROPOSED THOMPSONS POINT INTERCEPTOR
PORTLAND INTERNATIONAL JETPORT
PORTLAND TERMINAL
LEGEND
EXISTING SEWER LINES
PROPOSED SEWER LINES
EXISTING POWER TRANSMISSION LINES
EXISTING PIPELINE
EXISTING WATER LINE
EXISTING SEWER OUTFALLS
PORTLAND TERMINAL COMPANY
MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS
ENVIRONMENTAL IMPACT STUDY
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Prepared by
Edwards and Kelcey
Scale in Feet
500 0 1000

FIGURE 14

f. Retail Trade

According to the Land Development Plan, the City of Portland is experiencing a commercial growth rate which approximates an increase of 250,000 square feet of floor space per year. This growth has added over $20 million to assessed valuation of property in the City. Major redevelopment is occurring in the central business district of downtown Portland (a retail trade center for the region) with both private and public sources participating. The Maine Way Urban Renewal Program involves 35 acres in the center of the downtown area and is divided into 18 separate parcels with three already purchased by private developers. The renewal project has a total of $13 million pledged by both the U.S. Department of Housing and Urban Development and the City government. The development of banks, office buildings, restaurants, retail outlets, hotels and parking garages are all planned for this program with construction under way for some.

The revitalization of the Old Port Exchange Area is also pointed to in the Land Development Plan as being a major source of new retail development.

Although receiving strong competition from the Maine Mall Shopping Center, the central business area for the City should retain its role of retail leadership for the region as these projects are completed. Within the study area itself, retail trade outlets are primarily located along Brighton Avenue, with a second area being the West Gate Shopping Mall near the intersection of Congress Street and Stevens Avenue (Bradley's Corner).

Within the study area, commercial activity is generally concentrated along Brighton Avenue. Between the Brighton Avenue-Stevens Avenue intersection (Brighton Corner) and the Westbrook Connector (a distance of approximately 2.1 miles), there currently are some 70 retail or service establishments, one wholesale outlet and one extractive (sand and gravel type) operation. Easterly of a small shopping/business center at the Brighton Avenue-Capisic Street intersection, commercial uses are concentrated at two intersections: Brighton Avenue-Woodford Street-Montrose Street and Brighton Avenue-Stevens Avenue. Westerly of the Brighton Avenue-Capisic Street intersection, commercial use is strongly influenced by the proximity of the Maine Turnpike Exit 8, characterized in part by the regionally-oriented Pine Tree Shopping Plaza (at the Portland Connector) and the Bradlees Family Center shopping area (located east of the Turnpike exit), two restaurant-hotel complexes and four gasoline service stations.

Highway-oriented sales outlets traditionally subject to economic losses due to bypass of the establishment are generally associated with three major retail categories: gasoline service stations, eating and drinking places (restaurants, cafes, bars), and transient lodging (motels). There are 17 such enterprises along the 2.1-mile section of Brighton Avenue being studied, consisting of nine service stations, six restaurants and two motels. The section of Brighton Avenue located between the Westbrook Connector and the Portland Connector (the area immediately adjacent to Turnpike Exit 8) contains both motels, five of the six restaurants, and four of the nine gasoline stations.

It can be assumed that because of their location, the motels are heavily reliant on traffic exiting the Maine Turnpike; the restaurants and gasoline stations are also dependent on the shopping center traffic. Other commercial enterprises in the immediate area include two automobile agencies, two tire stores and a movie theatre complex.

With the exception of the remaining restaurant and five gasoline stations, the other businesses along Brighton Avenue are not highway-oriented. There are a variety of retail establishments, consisting of neighborhood convenience-type stores and shops (groceries, hair dressers, etc.) and specialized services such as real estate, insurance and furniture upholstery.

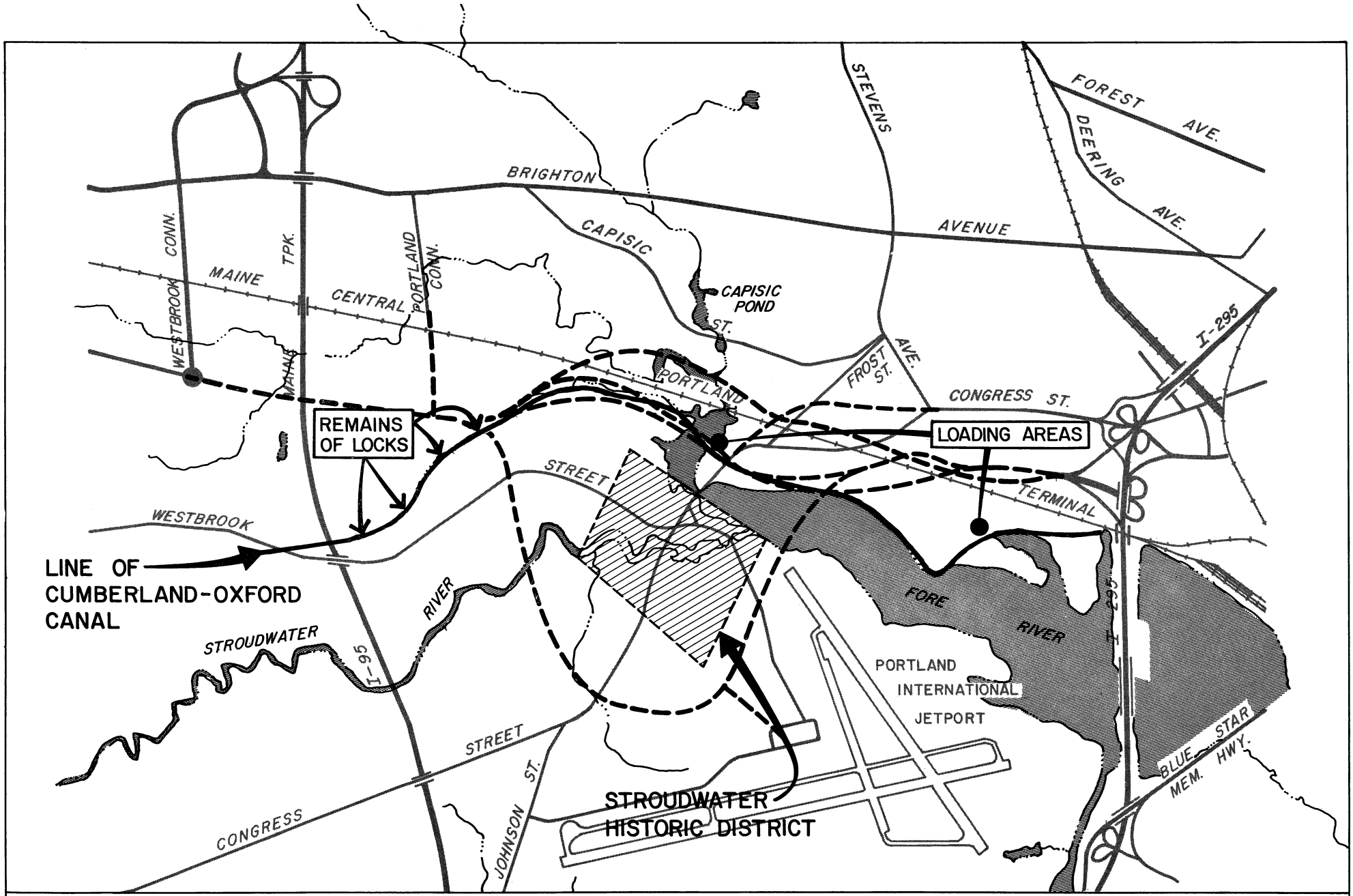
g. Historic Features

The Stroudwater Historic District and the abandoned Cumberland and Oxford Canal are two significant historic features of the study area. Information on these was available from the National Register of Historic Places inventory-nomination forms.

The Stroudwater Historic District (Figure 15) encompasses an area of approximately 115 acres. The District was submitted in January of 1972 to the Department of Interior for inclusion in the National Register of Historic Places. Approved as an historic district in 1973, the area has a prominent position in the history of the city. Settled in 1727 by Colonel Thomas Westbrook, the area contains some of the oldest homes in Portland, representing fine examples of 18th and 19th century architecture. Of particular note is the George Tate House built in 1755 and registered in the Historic American Buildings Survey. This home has been restored and is run as a museum by the National Society of Colonial Dames in Maine. Occupying a strategic point on the banks of the Fore River, the Stroudwater Historic District was a focal point for shipbuilding and commercial activity as well as a jumping-off point for inland trade on the Cumberland and Oxford Canal. Today, the area is residential in nature and provides both residents and visitors alike with a visual reminder of Portland's history.

The Cumberland and Oxford Canal was built to allow development of interior portions of the State of Maine and to provide a waterway which would allow the transport of people and materials both into and out of the inland areas it served. Opened in 1830, the canal had an excavated length of 20 miles and used 18 miles of existing water bodies for the remainder of its 38-mile length. The canal ran from Harrison on Long Lake, through Sebago Lake, overland to the foot of Clark Street at the Portland waterfront. Because Sebago Lake is 200 feet above sea level, 22 locks were built along the canal line to provide lift for canal barges. These locks were approximately 80 feet long and 10 feet wide and were constructed with either field stone or cut granite. The locks were then lined with wooden planking. There are still remains of these locks on the abandoned canal line in the study area (Figure 15). The canal ceased operations in 1872 due to competition from the railroads.

A portion of the Cumberland and Oxford Canal has been nominated, but not yet approved for inclusion on the National Register of Historic Places. This



MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

ENVIRONMENTAL IMPACT STUDY
WESTBROOK ARTERIAL • WESTBROOK-PORTLAND

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HISTORIC FEATURES

FIGURE 15

nomination included that part of the canal from Sebago Lake down to Connant Street in the City of Westbrook. The part of the canal which appears in the study area was not included for nomination to the National Register.

A proposal by Joel W. Eastman, Assistant Professor of History at the University of Maine at Portland, has been made to the Greater Portland Council of Governments to establish a historic-recreation site along the canal in the study area. This proposal is now under study by the Council of Governments.

2. Visual Features

The most prominent visual feature in the study area is the Fore River with its associated tidal wetlands which extend both east and west of the bridge at Congress Street. These wetlands have a flat topography providing vista-like natural views. The Stroudwater section of the city of Portland is located to the south of the Fore River. This rural neighborhood contains the Stroudwater Historic District which is visually reminiscent of architecture in the 18th and 19th centuries. The Portland International Jetport is located in Stroudwater on the south side of the river and is visually prominent from the northerly banks. Low density residential development occurs in Stroudwater Center as well as along Congress Street and Westbrook Street. However, much of the remaining area from the Portland International Jetport north to the Portland Connector is open space composed of woods and fields and traversed by the Stroudwater River.

To the west of the Fore River marshes, the topography is one of gently rolling, wooded hills crossed by utility rights-of-way.

To the north of the Fore River the study area becomes more suburban in character with mostly single-family homes on quiet residential streets. Along Brighton Avenue and the easterly portion of Congress Street this residential use is interrupted by some commercial development.

In the easterly portion of the study area Thompson's Point is prominent, with the land being developed as an industrial zone. I-295 forms an obvious visual boundary to the study area in this vicinity.

3. Air Quality

a. Nature and Effects of Automotive Pollutants

Human, animal, and plant life are affected by many gaseous and particulate substances generated by human activity and disposed of into the atmosphere. These substances result primarily from industrial or commercial activities, residential heating, and use of transportation facilities.

By far the greatest transportation contributor to pollution is the motor vehicle. The significant pollutants from this source are carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (NOx). The Maine Implementation Plan, adopted by the Department of Environmental Protection in 1972, indicated that automotive emissions of CO, HC, and NOx account for 88, 64 and 47 percent, respectively, of the total Metropolitan Portland Air Quality Control Region emissions for these pollutants. Various concentration levels of carbon monoxide, hydrocarbons, and nitrogen oxides affect human and animal health, cause vegetative and material damage (corrosion, discoloration, ozone cracking) and produce other environmental impacts (odor, decreased visibility, weather modification, soiling, etc.).

Carbon monoxide, a colorless, odorless and tasteless gas, is the most widely distributed and most commonly occurring air pollutant, normally exceeding all other pollutants combined on a weight basis. Most atmospheric carbon monoxide is produced by the incomplete combustion of fuels. The activities of man are responsible for almost all the carbon monoxide in his environment; since natural sources of carbon monoxide are negligible. Studies have shown that carbon monoxide concentrations generally correlate well with traffic volumes.

Carbon monoxide is absorbed exclusively by the lungs. It reduces the oxygen-carrying capacity of the blood, since the affinity of hemoglobin for carbon monoxide is over 200 times that for oxygen. Exposure to carbon monoxide can cause impairment of the ability to discriminate time intervals, and serious impairment of the central nervous system is a possible effect in extreme cases. However, these effects are not usually associated with outdoor activities and traffic generated carbon monoxide.

Hydrocarbons are a precursor of photochemical oxidants. The sole purpose of prescribing a hydrocarbon standard is to control photochemical oxidants. There are no known direct health effects due to hydrocarbons in the quantities normally produced by automotive sources. The largest amounts of hydrocarbons in the atmosphere are biological in nature and arise from natural sources. Most of these hydrocarbons are in the form of non-reactive methane and do not present the concern that the non-methane hydrocarbons from automotive sources create. The latter undergo a complex series of atmospheric reactions initiated by sunlight, the end product being photochemical oxidants.

Nitrogen oxides, like hydrocarbons, contribute to the formation of photochemical oxidants. Although motor vehicle emissions are usually the primary source of nitrogen oxides, certain manufacturing and chemical processes do contribute to local highs.

Adverse health effects of the oxides of nitrogen are dependent on concentration levels and exposure time. Test results are usually reported on the basis of annual average concentrations as short term exposures do not appear to be injurious to health. The small amount of information available concerning the toxicological effects of the oxides of nitrogen in man pertains to levels higher than those found in ambient air.

Photochemical oxidants are not directly emitted by vehicles. They are formed through the reaction of hydrocarbons and nitrogen oxides in the presence of sunlight, considerably downwind of the source of the reactants. All of the reactants, products and effects of the entire process are not fully documented at this time, but observed effects on humans include eye and respiratory irritation. Many types of vegetation also suffer adverse effects.

Particulate matter is introduced into the atmosphere from a variety of sources. Although automotive emissions usually account for less than 10 percent of the total by weight, they do add to the total effect of this pollutant on health, vegetation, local climate, visibility and aesthetics. The magnitude of the impact is dependent on the size and distribution of the particles. Lead-free gasolines (which will be mandatory beginning with 1975 model year cars) will reduce the contribution from automotive sources.

b. Ambient Air Quality Standards

The Federal Environmental Protection Agency (EPA), acting under the mandate of the Clean Air Act as amended in 1970, promulgated national ambient air quality standards on April 30, 1971, for six major air pollutants. The standards are of two kinds: primary standards to safeguard public health, and secondary standards to protect public welfare.

To implement, maintain, and enforce these standards, Section 110 of the Act requires all air quality control regions to adopt an implementation plan. The plan must provide for the attainment of standards at least as strict as the national primary standards by May, 1975. Secondary standards must be attained within a "reasonable time" thereafter, which is interpreted to mean three years except where good cause is shown for postponement.

Of the six pollutants for which Federal standards have been established, four--directly or indirectly--are largely of automotive origin. Consequently, the control strategy for these pollutants--carbon monoxide, hydrocarbons, nitrogen oxides, and photochemical oxidants--rely primarily on the Federal motor vehicle emission standards. The emission standards for carbon monoxide and hydrocarbons, which were to have taken effect on the 1975 models, have been extended one year to 1976. A re-evaluation of the nitrogen oxide standard has also allowed for a one-year extension to comply with the mandates of the National Emission Standards Act. The standards which were to have taken effect on the 1976 models will now apply to the 1977 models. Interim standards have been established for the three pollutants for which time extensions have been granted.

Federal and State of Maine air quality standards for the four major pollutants and particulates are presented in Table 8. While Maine has adopted Federal standards for CO, HC, NOx and photochemical oxidants, it has established standards for particulates which are more restrictive than Federal secondary standards.

Table 8

FEDERAL AND MAINE AMBIENT AIR QUALITY STANDARDS*

Pollutant	Federal		Maine
	Primary ug/m^3 (ppm)	Secondary ug/m^3 (ppm)	ug/m^3 (ppm)
Carbon Monoxide			
Max. 8 hr.	10** (9)	10** (9)	10** (9)
Max. 1 hr.	40** (35)	40** (35)	40** (35)
Hydrocarbons (Methane-free)			
Max. 3 hr.	160 (0.24)	160 (0.24)	160 (0.24)
Nitrogen Oxides			
Annual Arithmetic Average	100 (0.05)	100 (0.05)	100 (0.05)
Photochemical Oxidants			
Max. 1 hr.	160 (0.08)	160 (0.08)	160 (0.08)
Particulates			
Annual geometric mean	75 ----	60 ----	50 ----
Max. 24 hr.	260 ----	150 ----	100 ----

* Standards other than annual average may be exceeded once per year;
** Concentration is in milligrams per cubic meter rather than in micrograms per cubic meter.

c. State Implementation Plan

The Maine Implementation Plan was adopted by the State of Maine, Department of Environmental Protection in January, 1972. The State Implementation Plan identifies the Metropolitan Portland Air Quality Control Region as a Priority III area for carbon monoxide, photochemical oxidants (hydrocarbons) and nitrogen dioxide since sufficient ambient air quality data are not available for these pollutants and since the region did not have an urban place population that exceeded 200,000 in 1970. The Plan is designed to serve as an overall program for air pollution control efforts. The Maine Department of Environmental Protection is responsible for its implementation through the Bureau of Air Quality Control. The design of the Plan is to implement national secondary standards by June, 1975.

The State is divided into five Air Quality Control Regions. The study area is in the Metropolitan Portland Air Quality Control Region. There are six monitoring sites in this Region, of which five are in Portland and South Portland. However, these sites monitor only particulates and sulfur dioxide (SO_2). Although the mobile units are equipped to monitor CO, HC, and NO_x Federal regulations do not require monitoring of these latter three pollutants in a Priority III area.

Enforcement of air quality standards for stationary sources is provided through the Maine Site Selection Law. This law requires prior approval of all major developments by the Department of Environmental Protection. Mobile sources are expected to be adequately controlled by the required emission control devices; thus no formal transportation control strategy has been included as part of the State Implementation Plan.

Recent EPA regulations mandated that all State Implementation Plans be revised to include the designation of Air Quality Maintenance Areas (AQMA). These areas, where potential violations of standards might occur within 10 years (primarily due to indirect sources), must be addressed in terms of attaining and maintaining national standards of air quality. The State of Maine made an unofficial submittal in April, 1974, indicating that the Portland SMSA was evaluated and that no potential violation of a national ambient air quality standard within 10 years was found. The Administrator of the EPA had previously classified the Portland SMSA as an AQMA. In July, 1974, the Administrator re-evaluated the position of the EPA, found concurrence with the State's determination, and is therefore proposing no AQMA for the Metropolitan Portland Air Quality Control Region.

d. Climate

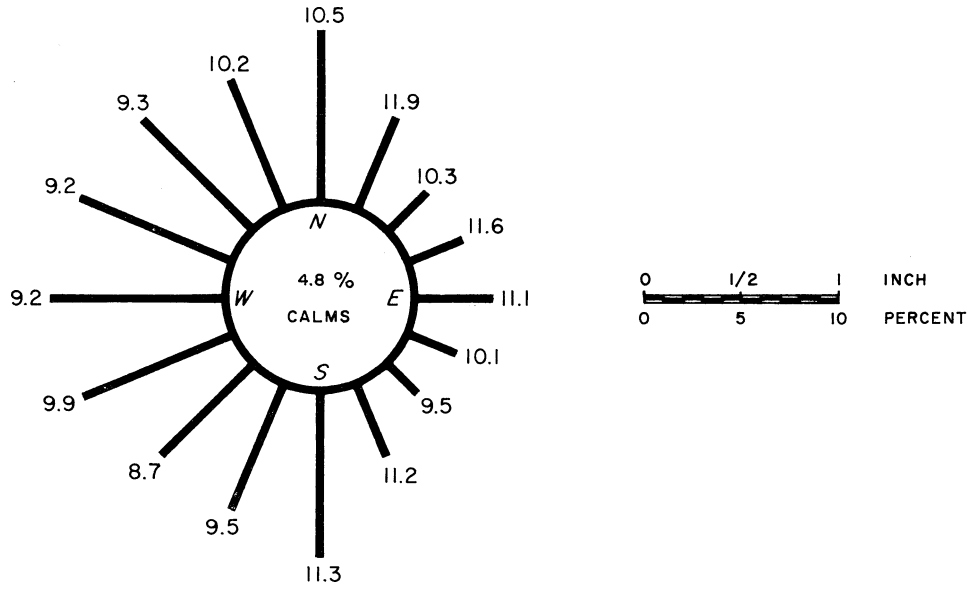
Many factors affect the air pollution generated by vehicles. These include local meteorologic conditions, wind speed and direction, altitude, topography, vehicle speed, operation mode, traffic mix, and emission control. Methods to estimate air pollution from vehicles may vary by the type of pollutant and the state-of-the-art. A study of climate is essential to evaluate the impact of a source of pollution on a receptor, because the frequency of various atmospheric conditions determines how the transport of pollutants will be affected as they leave the source.

The pollutant concentration at a downwind receptor is affected by wind direction, the angle of the wind with the highway, wind speed, atmospheric turbulence, and mixing depth. Weather data recorded at Portland International Jetport, in the study area, was employed in the evaluation of the Westbrook Arterial impact.

An annual wind rose showing the frequency of wind direction and average wind speed appears on Figure 16. The greatest frequency of observations is from the westerly-most quadrants and wind speed is near constant at approximately 10 mph.

Figure 16

ANNUAL WIND ROSE--PORTLAND INTERNATIONAL JETPORT



Note: Numbers indicate average wind speed in mph at ground level (based on 87,672 observations). Lengths of lines indicate frequency of occurrence.

SOURCE: Adapted from Decennial Census of U.S. Climate - Summary of Hourly Observations, Portland, Maine, Climatography of U.S. No. 82-17 U.S. Department of Commerce, Washington, D.C. 1963, p. 15.

The annual and monthly frequencies of wind speeds and directions shown in Table 9 contribute to an understanding of the probability of occurrence of worst wind conditions and assist in the identification of expected downwind areas. The table shows percentages of calms, prevailing wind directions for 1-3 mph, percent of time winds equal or exceed 4 mph, prevailing wind directions for all wind speeds, and average wind speeds for the wind directions with the highest frequency of occurrence.

Atmospheric turbulence, mixing height, and wind speed determine the degree of dilution of pollutants after they leave the source. Generally, turbulence results from mixing due to rough terrain, and the vertical movements of warm and cool air. The height or mixing depth to which the air movement or thermal turbulence extends from the surface varies from several thousand to less than 100 feet according to time of day, cloud cover, atmospheric pressure, and season. In the study area, according to climatological data published by the U.S. Department of Commerce, only 1.3% of the annual observations indicate a mixing depth less than 100 feet.

Turbulence is defined in terms of observable meteorologic parameters for modeling and prediction purposes. A system of "stability classes" generalizes meteorologic conditions into six categories as follows:

Stability	Description of Atmosphere
A	Extremely Unstable
B	Unstable
C	Slightly Stable
D	Neutral
E	Slightly Stable
F	Stable

Table 10 identifies the meteorologic parameters which determine stability class. Stability F represents the atmospheric conditions most conducive to high pollutant concentration. This occurs when there is rapid cooling at the surface or air subsidence due to the presence of a high pressure cell. Cooling of the surface occurs mostly at night, and the rate is greatest with the least cloud cover.

Table 9

WIND ANALYSIS

Period	% Calms	Prevailing Wind Direction: 1-3 mph	% Wind ≥ 4 mph	Prevailing Winds	
				Direction	Mean Speed (mph)
Annual	4.8	W	89.9	W	9.2
January	3.6	W-WNW	92.3	N	11.0
February	4.2	W	90.8	WNW	11.1
March	3.1	W	92.9	N	12.0
April	3.6	WNW	92.4	S	12.2
May	3.8	NW	91.3	S	11.9
June	5.5	W-WNW	88.8	S	11.5
July	5.9	W	87.0	S	10.8
August	6.3	W	86.9	S	10.9
September	5.5	W	88.8	S	11.3
October	5.2	W-NW	89.9	N	9.9
November	5.2	W	89.0	W	9.2
December	5.2	W-WNW-NW	89.4	N	10.4

SOURCE: Adapted from Decennial Census of U.S. Climate-Summary of Hourly Observations, Portland, Maine, Climatography of the U.S. No. 82-17, U.S. Department of Commerce, Washington, D.C., 1963, p. 15.

Table 10

ATMOSPHERIC STABILITY CLASSES

Surface Wind Speed (m/sec)	Daylight Insolation			Nighttime Conditions	
	Strong	Moderate	Slight	Thinly Overcast or ≥ 4/8 Cloudiness	≤ 3/8 Cloudiness
≤ 2	A	A-B	B	--	--
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
≥ 6	C	D	D	D	D

e. Traffic and Emission Characteristics

While atmospheric conditions determine the means by which pollutants are transported, traffic and emission characteristics provide the source parameters. The emissions from the "highway line source" are determined by the traffic volume, the vehicle mix, and vehicle emission characteristics.

The traffic volume criteria are different for the micro-scale (evaluation of point concentrations at receptors close to the highway) and meso-scale (evaluation of the overall effect on the air basin) analyses. To address the 1-hour and 8-hour maximum expected concentrations required in the micro-scale analysis for CO, the traffic used in the model represents the peak hour conditions and the 8-hour period with the greatest vehicle count. The traffic used in the meso-scale analysis is the annual average daily traffic.

Since controlled vehicles emit significantly less pollutants than uncontrolled vehicles, it is important to know what proportion of the vehicles on the road are uncontrolled. But the effectiveness of controlled vehicles deteriorates with age, so that it is essential that the distribution of controlled vehicles by model year is also known. In this study, the U.S. national average vehicle mix (in terms of weighted annual mileage for both automobiles and trucks) was used in the absence of data specifically applicable to the Portland Metropolitan Area. It should be noted that the vehicle mix is not significantly different from one location to another. The national average vehicle mix was obtained from Compilation of Air Pollutant Emission Factors, 2nd Edition, U.S. Environmental Protection Agency, April, 1973, (AP-42).

The percentage of light-duty, gasoline-powered (LDG) vehicles, heavy-duty, gasoline-powered (HDG) vehicles, and heavy-duty, diesel-powered (HDD) vehicles must also be considered since the emission characteristics for these vehicles are different. Traffic data indicate that Brighton Avenue and the proposed Arterial would be expected to carry approximately 5% truck traffic in both 1974 and 1994. The percentage is applicable to AADT and DHV. In order to

utilize a representative vehicle mix in the analyses, the peak hour, 8-hour maximum and the average daily traffic were all assumed to have 95% LDG, 3% HDG and 2% HDD.

Although peak hour and 8-hour maximum traffic volumes are available for specific locations, they must be computed for each segment of roadway where there is a change in traffic volume. Since traffic projections are generally in terms of annual average daily traffic (AADT), the peak hour and 8-hour maximum volumes are expressed as percentages of AADT as shown in Table 11. They were determined from actual traffic counts in the study area supplied by the Bureau of Planning.

Table 11

TRAFFIC VOLUME SCALE-UP FACTORS

	% of AADT Volumes	
Traffic Volumes	Arterial	Local Streets
Annual 1-Hour Maximum	10.5	9.0
Annual 8-Hour Maximum	65.0	65.0

Vehicle operating speeds are dependent upon the number of vehicles on the highway, and the capacity of the facility to accommodate those vehicles. The speeds used in the analyses were determined from data supplied by the Bureau of Planning and are summarized in Table 12. The traffic zones for which speeds are indicated appear on Figure 17, page 61.

Table 12

VEHICLE OPERATING SPEEDS - 1974 DO-NOTHING*

Speed	Applicable Zones
20	3, 6, 9
25	4, 5
30	1, 2, 8, 14, 15, 16, 17, 18, 19
35	7, 10, 11, 12, 13

*Note: (1) The speeds shown above apply to both micro- and meso-scale analyses.
(2) The 1994 Do-Nothing speeds are 5 mph less; the 1974 "build" speeds are 5 mph greater; the 1994 "build" speeds are the same.
(3) The speeds on the Westbrook Arterial would be 47 mph in 1974; 42 mph in 1994.

Table 13

EFFECT OF VEHICLE MODE ON EMISSIONS

Condition		Exhaust				Blowby[a]	Fuel System[c]	
			Concentration			Flow[b]	Flow[b] HC	
Vehicle	Engine	Flow	HC	CO	NOx		Tank	Carburetor
Idle	Operating	Very low	High	High	Very low	Low	Average to Moderate	Moderate
Cruise								
Low speed		Low	Low	Low	Low	Moderate		Small
High speed		High	Very low	Very low	Moderate	High		Nil
Acceleration								
Moderate		High	Low	Low	High	Moderate		Nil
Heavy		Very High	Moderate	High	Moderate	Very High		Nil
Deceleration		Very low	Very high	High	Very low	Very low		Moderate
Soak	Stopped					None	High	High
Hot		None	---	---	---			
Diurnal		None	---	---	---	None	Moderate	Very low

[a] Concentration of HC is high, CO is low, and NOx very low
[b] Flows are at least one order of magnitude lower than the exhaust flow
[c] For a vehicle not equipped with an evaporative emission control system

SOURCE: Control Techniques for Carbon Monoxide, Nitrogen Oxide, and Hydrocarbon Emissions from Mobile Sources. (AP-66), U.S. Department of Health, Education, and Welfare, National Air Pollution Control Administration - March, 1970.

Vehicle emissions change with vehicle speed, and the rate of change varies according to the pollutant. Speed adjustment factors are given in AP-42. Emission characteristics for LDG, HDG, and HDD vehicles standardized for a 19.6 mph average test speed are also given in AP-42. The emission factors must be adjusted for vehicle mix, speed and the percentage of HDG and HDD trucks to give an emission factor for the average vehicle for the time interval of concern. Table 13 has also been included to show the relationship between mode of operation and emissions for CO, HC and NOx.

f. Methodology

The model employed in this study for micro-scale analysis was prepared by the State of California Department of Public Works, Division of Highways, under the sponsorship of the Federal Highway Administration. In its application to highway problems, various refinements and modifications are employed under guidelines recommended by the EPA. The model is used to predict point concentrations for sensitive receptors (schools, hospitals, playgrounds) or for stations where relatively high concentrations may be expected due to highway configuration and traffic volumes.

Application of the prediction model to a micro-scale analysis requires obtaining data on vehicle and traffic characteristics and on climate. Initially, climatic and meteorologic information is evaluated to determine the most probable conditions for high pollutant concentration. Receptors, which are either sensitive or expected to have high pollutant concentrations based on wind direction and highway orientation, are then selected for evaluation. The distance between the receptor and the highway, the wind orientation with the highway, and the stability class determine the dispersion characteristics of the pollutant as seen from the receptor. Wind speed and emission data are then introduced to compute the point concentrations. Concentration is directly proportional to emissions, while it is inversely proportional to wind speed.

Because of the reactivity of HC and NOx, the dispersion characteristics for these pollutants have not been accurately modeled. For this reason, the line source diffusion model has only been applied to CO.

Micro-Scale Analysis for Carbon Monoxide - In applying the model to the micro-scale analysis, certain conditions were imposed in order to develop the most conservative estimates of pollutant concentration at downwind receptors. The greatest potential for adverse air quality occurs during stable atmospheric conditions that have the tendency to suppress vertical motion and thus contain air pollutants at lower elevations. Stability "F", the most stable surface condition (and consequently, the condition most conducive to air pollution), was selected to predict air pollutant concentrations. A low wind speed of 2 miles per hour, although not necessarily the prevalent wind speed for the stability class and wind directions used, was selected in order to simulate worst conditions. Further, the angle of the wind with the highway was assumed as 22.5 degrees for single source analysis or was assumed as originating from the direction which would cause the greatest combined concentration for multiple upwind sources.

As indicated previously in Table 8 on page 51, ambient air quality standards have two restrictions--an allowable pollutant concentration level and a time limit on the duration of that pollutant concentration. To simulate the worst pollutant levels, the maximum traffic volumes were used in conjunction with the most unfavorable atmospheric conditions (stability F, 2 mph wind speed, wind direction causing the greatest downwind pollutant concentrations).

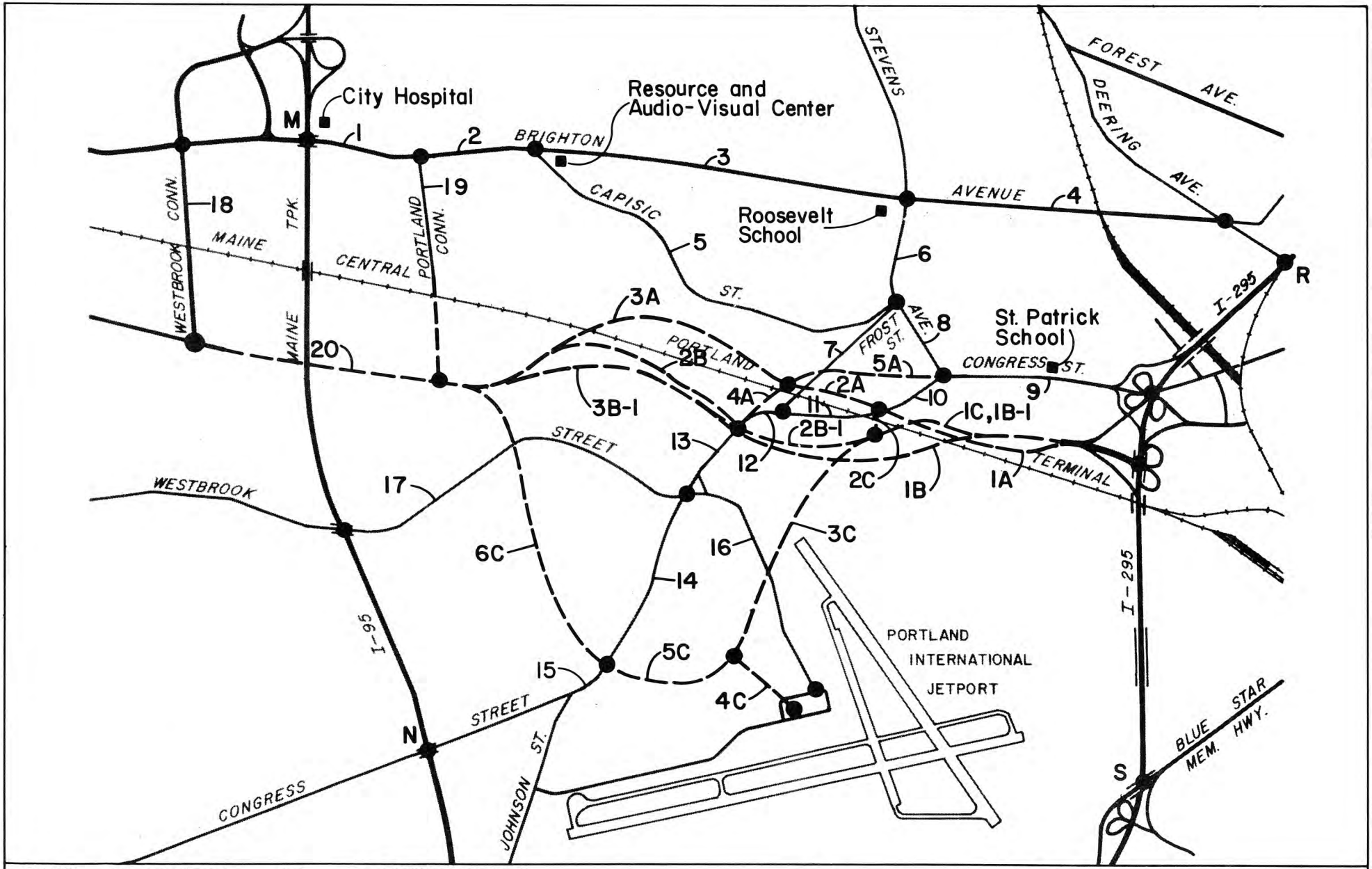
Micro-scale air pollutant concentration predictions were made for the Do-Nothing alternative and for alternates A, B, B-1, and C for 1974 and 1994. The analysis addresses the impacts on zones and sensitive receptors. A zone is a line adjacent to a road segment with distinct traffic and speed characteristics. The line is at the typical structure setback distance for local streets and at the approximate right-of-way line for the proposed routes and existing interstate highways. Thirty-eight zones, adjacent to thirty-eight road segments, were established, of which fifteen are along the proposed arterial routes. The road segments corresponding to these air quality zones are identified on Figure 17. The offsets selected for the zones are given in Table 14.

Table 14

OFFSET DISTANCES FOR AIR QUALITY ZONES

Offset Distance (feet)	Zones
25	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 4A, 5A
30	6, 7, 8, 16, 17
50	18, 19
100	20, 1A, 2A, 3A, 1B, 2B, 1B-1, 2B-1, 3B-1, 1C, 2C, 3C, 4C, 5C, 6C, M-N, R-S

The concentrations calculated for each of the thirty-eight zones were based solely on the impact of the adjacent road segment. The calculations were based on winds at 2 mph and 22.5 degrees to the road segments and stability F conditions. The results of the 38-zone analysis serve as a comparison of concentrations throughout the air basin and aid in the identification of the potential high concentration areas. The identified potential high concentration zones were evaluated in terms of the combined impact of all upwind roads using the wind direction which would cause the greatest impact, wind speed at 2 mph, and stability F conditions (5-zone analysis). This procedure assured the most conservative estimates of concentrations in the potential high concentration zones identified earlier.



MAINE DEPARTMENT OF TRANSPORTATION
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ENVIRONMENTAL IMPACT STUDY
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MICRO-SCALE AIR ANALYSIS ZONES

FIGURE 17

In addition to the zonal analyses, four sensitive receptors (one hospital and three schools) were selected for air quality evaluation (4-receptor analysis). These receptors are identified on Figure 17. Again, worst wind direction, wind speed at 2 mph, and stability F conditions were assumed.

All micro-scale estimates may be regarded as highly conservative since the values of the traffic and climatological variables employed are extremely unfavorable in terms of the generation and diffusion of pollution and will rarely occur simultaneously. Wind directions used were based on prevailing winds, but were adjusted to be at an angle with the roadway in order to produce potentially worst conditions.

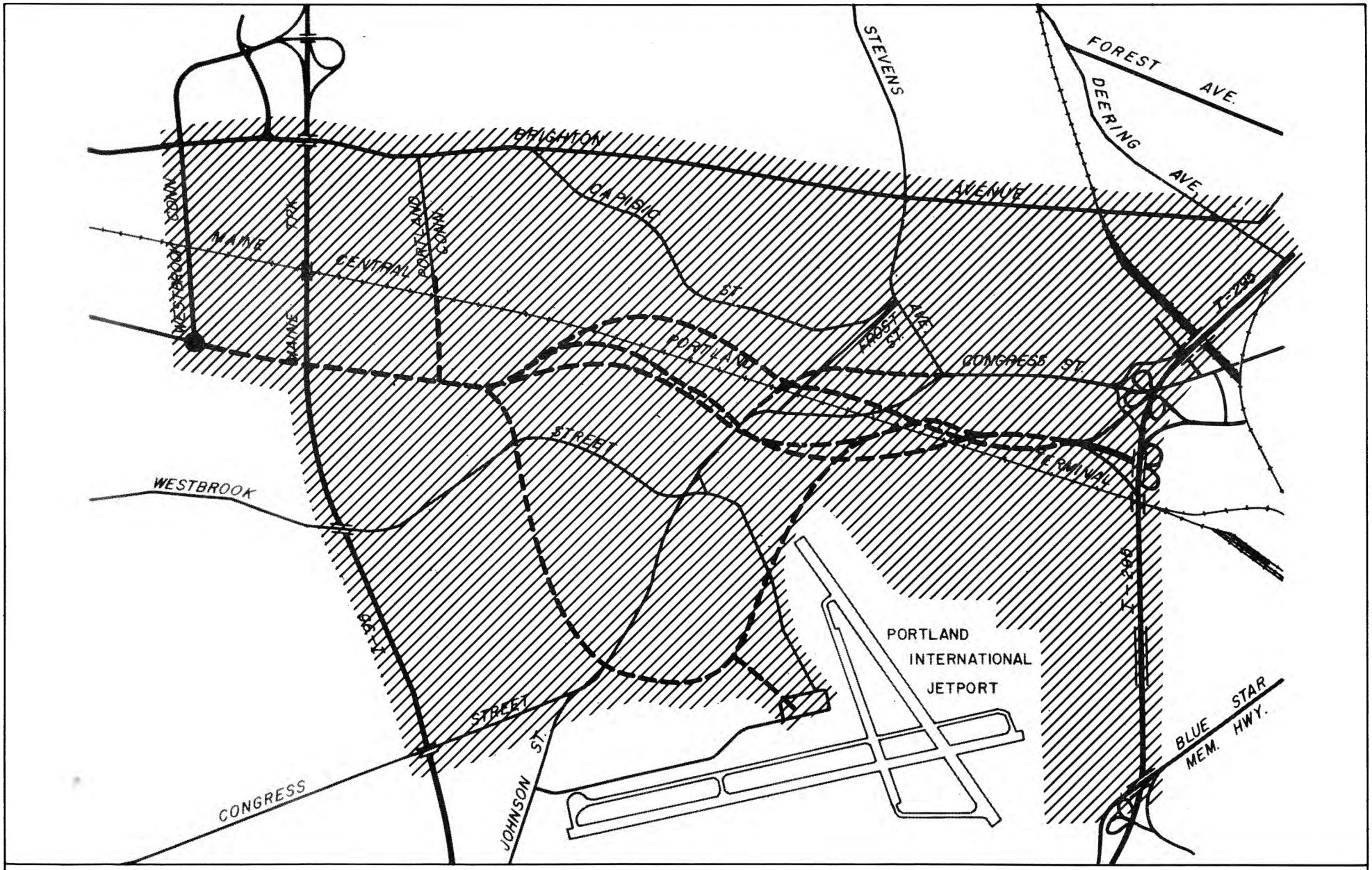
Due to the lack of significant stationary sources of CO, background pollutant levels can be almost entirely associated with automotive emissions. Thus, the estimates for CO, which are based exclusively on automotive emissions, should not significantly underestimate actual concentrations which result from all sources.

Meso-Scale Analysis - In addition to its effect on nearby receptors, a highway may have a significant effect on overall air quality. This effect results from a change in pollutant burden on the immediate air basin. The change in pollutant burden is a function of rate of change in traffic volumes and speeds throughout the network and in emission factors. In order to make this assessment, a meso-scale analysis was made to predict the pollutant burden change.

The same conditions as for the micro-scale analysis were addressed--i.e., Do-Nothing and the four build alternatives for 1974 and 1994. The same road segments and traffic volumes which were used in the micro-scale analysis, were employed in the meso-scale analysis to compute the total tonnage of pollutants resulting from each alternative for both years. The meso-scale air basin used as a basis of comparison of alternates is delineated on Figure 18.

The results of the meso-scale analysis are given in tons of pollutant emitted per year on the roads under evaluation. The evaluation was made for carbon monoxide, hydrocarbons, and nitrogen oxides. Particulates, emitted in relatively small quantities by light-duty, gasoline-powered vehicles when compared to CO, HC, and NOx, were not estimated for this study. Lead-free gaoslines are expected to reduce particulate emissions to a point where concern is even further reduced.

The results of the air quality analyses are presented later, in Section IV.C.



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MESO-SCALE AIR BASIN

FIGURE 18

4. Noise Environment

Of the environmental pollutants of current concern, noise is perhaps the most annoying to the average person. Noise, often defined as "unwanted sound," is everywhere. In urban areas, the sound of air conditioners, pneumatic hammers, aircraft, automobiles, trucks, and the neighbor's television intrude on the natural quiet of the environment.

As an introduction, a brief discussion of the physical characteristics of sound and noise and their measurement is included, which will be helpful in understanding the results of the noise impact assessment for this project.

a. Description of Noise

The origin of sound is mechanical vibration, and the propagation of these vibrations in a gaseous medium such as air takes place in the form of density variations, which can be measured by determining the associated changes in pressure in terms of force per unit area (dyne/cm^2, or microbar). The weakest sound pressure detectable by a young person with extremely good hearing is 0.0002 microbar, while the largest sound pressure perceived without pain is of the order of 1000 microbar. Thus the scale of sound pressures covers a range of 1:10,000,000. The sound pressure scale is rather large, and since the ear responds to a change in sound pressure in a relative way, a relative scale called the decibel scale was developed. The decibel (dB) is defined as ten times the logarithm to the base 10 of the ratio between two quantities of power. Since the sound power is related to the square of the sound pressure, the decibel scale reduces the scale of sound pressure of 1:10,000,000 to sound pressure levels of 0 to 140 dB. The term "levels" is introduced because the decibel represents a quantity a certain level above a reference quantity, normally 0.0002 microbar which corresponds to 0 dB.

The three parameters of importance in describing a noise environment are the loudness, the frequency spectrum, and the time-varying character of the sound.

The simplest physical measure of a noise would be to determine its overall sound pressure level, however, such a measurement would give no indication of the frequency distribution of the noise, nor would it give any information as to the human perception of it. By relatively simple means, it is possible to give a noise measuring instrument certain characteristics which make the measured results much more useful. This has been done with the now internationally standardized sound level meter. The sound level meter is supplied with a set of frequency weighting networks, the characteristics of which have been termed A, B and C. (The unit of frequency is the Hertz, or cycle per second.) The A-weighting, which suppresses the loudness of low frequencies and very high frequencies, provides a scale similar to the response of the human ear. The present international standards for noise measurement and evaluation recommend the use of A-weighting in the evaluation of traffic-generated noise. Sound levels used in this report are based on A-levels, and are expressed in decibel units written as dBA.

While the dBA measure accounts for the loudness and frequency spectrum of a noise environment, it does not provide any indication of the time-varying character of the noise. Adjacent to a highway, the noise varies as the traffic along the highway changes. By measuring instantaneous noise levels at certain intervals over a period of time, and arranging the individual noise levels by order of magnitude, one can easily obtain the noise level exceeded during any specific percent of time during the measurement period. The average noise level during the time of measurement is approximately equal to the noise level exceeded 50 percent of the time, and is described as L_{50}. Other commonly used single-number descriptors are L_{90} and L_{10}, the noise level exceeded 90% of the time and 10% of the time, respectively. Various methodologies have been developed in an attempt to relate these numerical descriptors to subjective evaluation of noise. At the present time, however, use of the L_{10} noise level in dBA units is felt to provide a valid means of describing a noise environment adjacent to a highway.

For reference and orientation to the decibel scale, Table 15 relates common environmental noises to their respective dBA levels. A few general relationships may be helpful in understanding some of the principles of sound generation and transmission. A decrease of 10 decibels will appear to an observer to be a halving of the loudness of the noise. For example, the rock and roll band shown in the table at 100 dBA would sound only half as loud as the elevated train at 110 dBA, and the boiler room at 90 dBA would sound only half as loud as the rock and roll band. A doubling of the noise source produces only a 3 dBA increase in noise levels. For example, a single garbage disposal is shown at 80 dBA; two disposals at the same location would produce 83 dBA.

b. Reaction to Noise

Social survey studies have placed the effects of noise on people into three general categories: the subjective effects of annoyance, nuisance and dissatisfaction; interference with activities such as speech, sleep and learning; and physiological effects such as startle and hearing loss. Since the same sounds are perceived differently by different people, there can be no completely objective measure of subjective reaction to noise. In terms of interference with speech or sleep, however, quantitative measures of noise criteria have been established.

It is generally recognized that the efficiency of humans is considerably higher under comfortable conditions than when they are constantly annoyed by their surroundings. Also, a certain degree of environmental quietness is a desirable quality in itself. People in general do not like to live in the immediate vicinity of an airfield, roads with heavy traffic, or other noisy places. Noise may bear considerable economic importance, such as affecting the value of adjacent land. Furthermore, in choosing utility items such as appliances, the quietness of the items is definitely considered by the buyer. The control of noise is therefore important not only from an annoyance and health point of view, but also from an economic viewpoint.

Table 15

COMMON ENVIRONMENTAL NOISE LEVELS (dBA)

INDOOR NOISE LEVELS	DECIBELS	OUTDOOR NOISE LEVELS
	140 ---	THRESHOLD OF PAIN
	130 ---	Pneumatic riveter
Oxygen torch	120 ---	
	110 ---	Elevated Train
		Jet flyover at 1000 feet
Rock and roll band	100 ---	
		Farm tractor
		Lawn mower at 3 feet
Boiler Room	90 ---	Motorcycle at 25 feet
Food blender at 3 feet		
		Diesel truck, 40 mph at 50 feet
Garbage disposal at 3 feet	80 ---	
		Lawn mower at 100 feet
Shouting voice at 6 feet	70 ---	
		Car, 50 mph at 50 feet
Normal speech at 3 feet		
	60 ---	Heavy traffic at 300 feet
Average business office	50 ---	
Average residence		Bird calls
	40 ---	
Library		
	30 ---	
		Quiet rural area at night
Broadcasting studio		
	20 ---	Rustling leaves
	10 ---	
	0 ---	THRESHOLD OF HEARING

c. Criteria for Impact Evaluation

To assess the impact of a new noise source, it is necessary to determine the relationship between the new intrusive noise and the existing or ambient noise environment. Reaction to the new noise environment can be categorized in a relative manner, based on the following information:

A one dBA increase in noise level cannot be distinguished by a listener.

A three dBA increase in noise level is a barely perceptible difference.

A five dBA increase in noise level is required to produce a change in community reaction to the noise environment.

A ten dBA increase is approximately equal to a doubling of the loudness.

On the basis of the preceding information, and the guidelines suggested in Highway Noise: A Design Guide for Highway Engineers (NCHRP Report 117), impacts of the proposed project are assessed in accordance with the following table.

Table 16

IMPACT DUE TO CHANGE IN AMBIENT NOISE

Increase or Decrease Over Ambient Level	Degree of Impact
0 - 5 dBA	No Impact
6 - 15 dBA	Some Impact
15 + dBA	Great Impact

SOURCE: Highway Noise: A Design Guide for Highway Engineers. National Cooperative Highway Research Program Report 117.

The impact determination in terms of changes in the ambient noise environment does not establish an upper limit on the noise levels from a highway facility. The Federal Highway Administration, under the mandate of the U.S. Congress, has established criteria to limit highway noise.

The Federal-Aid Highway Act of 1970 required the development and promulgation of standards for highway noise levels compatible with different land uses. At the present time, interference with speech communication is the best documented and most readily quantified parameter for use in determining the acceptability of a noise environment. Conditions requiring a minimum of effort to

maintain speech communication are an important index of environmental quality. While consideration of annoyance and disturbance is also a desirable basis for evaluating a noise environment, the lack of an established relationship to a numerical descriptor of noise levels precludes its exclusive application to a noise standard at the present time.

The design noise levels shown in Table 17 are the noise standards of the Federal Highway Administration (FHWA) and are based on speech interference factors. The single number descriptor L_{10} (the sound level exceeded for only 10% of a time) provides an indication of both the magnitude and frequency of occurrence of the loudest noise events. The standards, developed from research data, represent what has been determined as acceptable noise levels for a particular land use and its associated human activity; the noise levels would not be objectionable to the majority of persons exposed to them.

The design noise levels set forth in the standards represent the highest desirable noise level conditions. However, there may be sections of highway where it would be impractical to apply noise abatement measures to meet the design noise levels. The FHWA may grant exceptions to the design noise levels if, after consideration of noise abatement measures with respect to economic costs and benefits, aesthetic impact, air quality, highway safety and other similar values, it is determined that reduction of noise to design levels is not in the overall best public interest for that particular highway section.

d. Highway Noise Parameters

The three major parameters which affect traffic noise levels are the type and volume of traffic, the horizontal and vertical configuration of the roadway and the position of an observer with respect to the roadway.

Due to their different noise-generating characteristics, automobiles and heavy-duty trucks are analyzed separately. Traffic volumes are generally described in terms of vehicles per hour. The corresponding operating speeds determined by the traffic-carrying capacity of the highway or by posted speed limits.

For automobiles, the noise level increases as the volume and speed increase. For heavily traveled highways, the noise level will increase by about 3 dBA per doubling of traffic volume. Under normal cruising conditions, the engine-exhaust system and tire-roadway interaction are both major sources of noise.

Heavy-duty trucks, although representing a small proportion of the total vehicle population, are significantly noisier than cars. A single truck may generate noise levels on the order of 15 dBA higher than a single automobile operating under the same conditions. Since truck engines are generally operated at approximately constant rpm, truck noise is generally independent of speed. The engine and exhaust system is the predominant noise source, with tire-roadway noise of importance at higher speeds.

Table 17

DESIGN NOISE LEVEL/LAND USE RELATIONSHIPS

Land Use Category	Design Noise Level--L_{10}	Description of Land Use Category
A	60 dBA (Exterior)	Tracts of lands in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	70 dBA (Exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, playgrounds, active sports areas, and parks.
C	75 dBA (Exterior)	Developed lands, properties or activities not included in categories A and B above.
D	--	Undeveloped lands; future land use should be compatible with anticipated noise levels.
E	55 dBA (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums. (For use when no exterior noise-sensitive land use is identified.)

SOURCE: "Noise Standards and Procedures." Policy and Procedure Memorandum 90-2, U.S. Department of Transportation, Federal Highway Administration, February, 1973.

Roadway parameters affecting noise levels include the number of lanes, median width, pavement surface and gradient. Very smooth pavements can reduce noise from tire-roadway interaction, whereas a rough pavement increases the noise. While automobile noise is not affected by steep grades, truck noise levels can be increased by 2 to 5 dBA over level roadway conditions.

The noise heard by an observer adjacent to the highway can be affected by several factors, one of the most important being distance from the highway. Traffic noise will decrease by 4 to 6 dBA per doubling of distance (for example, the noise level at 200 feet will be 4 to 6 dBA lower than the noise level at 100 feet from the roadway). Elevating or depressing the roadway can reduce noise levels significantly. Natural ground contours blocking the line of sight to the roadway provide at least a 5 dBA reduction. Multiple rows of buildings or dense vegetation can reduce noise levels up to 10 dBA. Artificial roadside noise barriers, such as opaque walls or earth berms, under certain conditions, may provide up to a 15 dBA reduction.

e. Ambient Noise Levels

To evalute the impact of the proposed action adequately, the existing noise environment in the study area was determined through a field measurement program carried out by the Bureau of Highways during the two-week period between February 26 and March 12, 1974. Instantaneous noise levels (in dBA) were measured with a sound level meter at various locations in the study area as shown on Figure 20, page 77. The noise sampling procedure consisted of noting the noise levels at 10-second intervals for a period of 8 minutes and twenty seconds (until 50 samples had been recorded). At selected sites, measurements were taken simultaneously at distances of 30 feet and 60 feet from the center of the nearest lane of traffic, and, in some instances, the measurement procedure was repeated. Where appropriate, traffic volumes and speeds were observed during the measurement period and were later used to predict the noise level at the measurement site (as discussed in the following section "f"). During the measurement period, the observed noise levels are entered on a work sheet by order of magnitude. After 50 samples are recorded, the noise level exceeded ten percent of the time (L_{10}) is equal to the value of the 5th highest sample. The ambient noise measurements are summarized in Table 18 on pages 72 and 73.

Review of the ambient noise survey data indicates that close to the major traffic-carrying roadways in the study area, the L_{10} levels presently exceed 70 dBA. At the 30-foot offset measurement sites, the L_{10} level exceeded 70 dBA in all but one of the 63 data sets. The maximum L_{10} observed was adjacent to the Maine Turnpike--81 dBA at Site FT. For roadways of more particular interest to the proposed project, the maximum L_{10} level was recorded on Brighton Avenue--78 dBA at Site A. As expected, the noise levels decrease as distance from the roadway increases, thus at the 60-foot offset distance, the L_{10} levels exceed 70 dBA in only 34 of 61 data sets. At measurement sites more removed from major roadways the minimum L_{10} recorded was 46 dBA at Site J. At the remaining, more remote sites, the L_{10} values ranged from 49 to 58 dBA, an indication that the ambient noise floor, at least in the developed portions of the study area, is on the order of 55 dBA.

With the exception of Brighton Avenue, the major streets can be categorized as having almost exclusively residential land use abutting the street. The noise levels at the 30-foot offset are representative of front yard conditions, while the 60-foot offset noise levels are in the vicinity of side yards and the residential structures.

The Maine Turnpike is perhaps the dominant highway noise source in the westerly portion of the study area, due to its higher speeds and significantly greater volume of heavy-duty trucks. It can be expected that Interstate Route 295 on the eastern edge of the study area will become a significant noise source as well, when it is completed and open to traffic. (Ambient noise levels adjacent to the Turnpike will be reduced, since I-295 will attract much of the present traffic on the Turnpike.)

While motor vehicle noise is a significant factor in determining the overall noise environment, air traffic at Portland International Jetport must also be considered. Noise from aircraft overflights were noted in 13 of 81 data sets. These 13 sites fall within a triangle described by Site A on the north, Site AZ on the west, and Site V on the east.

The Airport Master Plan Report and accompanying Environmental Impact Statement (prepared in 1972-1973) provide some data on present and projected noise conditions due to operations at the Jetport. Noise Exposure Forecast (NEF) is a tool for estimating a single number rating of the cumulative aircraft noise nuisance around airport communities. NEF contours can be developed using estimates and generalizations of aircraft categories, mix of aircraft, runway utilizations, number of operations, flight paths, noise levels and wind direction. The Airport Master Plan Report uses NEF 30 and NEF 40 as impact criteria. (The Federal Aviation Administration suggests that residences, schools, hospitals and churches are incompatible with conditions within the NEF 30 and NEF 40 contours; for similar land uses, the FHWA has established a design noise level of 70 dBA L_{10}. The NEF is a psychologically derived measure of a noise environment, whereas the dBA L_{10} is a physical measure. Therefore, although NEF 30 and 70 dBA L_{10} could be considered equivalent in terms of defining noise impact, the two descriptors of a noise environment are not mathematically equal.) According to the Master Plan, noise complaints have been received from the Stroudwater area to the north of runway 18-36 (north-south runway) and, unless positive noise abatement action is taken, conditions will get worse in the future. NEF contours shown in the Master Plan indicate that noise penetration into the Stroudwater area is presently substantial; however, the contours are somewhat overstated in that they do not take into account the present curfew on airport operations between 11 p.m. and 7 a.m. (The NEF methodology imposes a heavy penalty for night flights, based on the premise that nighttime noise is more objectionable.) An additional mitigating factor is the current practice to concentrate all jet operations on the east-west runway to the maximum extent possible, thereby reducing noise exposure in the Stroudwater area.

Table 18

SUMMARY OF AMBIENT NOISE MEASUREMENTS

Site		Date and Time		Measured Noise Levels (dBA L_{10}) Offset: 30'	60'	Varies*
A	1	February 26, 1974	12:00 a.m.	75	70	
	2		4:30 p.m.	76	72	
	3		4:45 p.m.	73	70	
	4		5:00 p.m.	75	70	
	5	February 27, 1974	7:35 a.m.	75	71	
	6		7:55 a.m.	78	74	
B		February 26, 1974	1:00 p.m.			49 (1650')
C		February 26, 1974	1:35 p.m.			55 (2500')
D	1	February 26, 1974	2:10 p.m.	76	74	
	2		2:30 p.m.	75	73	
	3		2:45 p.m.	77	73	
E	1	February 26, 1974	3:15 p.m.	74	68	
	2		3:45 p.m.	76	72	
	3		3:55 p.m.	77	72	
	4	February 27, 1974	4:10 p.m.	74	68	
	5		4:20 p.m.	74	70	
	6		4:35 p.m.	76	72	
	7		4:45 p.m.	74	67	
F		February 27, 1974	8:35 a.m.			49 (650')
G		February 27, 1974	8:55 a.m.			52 (525')
H		February 27, 1974	9:15 a.m.			52 (420')
J		February 27, 1974	9:37 a.m.			46 (625')
K	1	February 27, 1974	10:30 a.m.	72	67	
	2		3:40 p.m.	72	65	
	3	February 28, 1974	3:00 p.m.	73	68	
L		February 27, 1974	10:50 a.m.			58 (1450')
M		February 27, 1974	11:05 a.m.			49 (625')
N		February 27, 1974	1:15 p.m.			53 (1350')
P		February 27, 1974	1:45 p.m.			52 (575')
Q		February 27, 1974	2:00 p.m.			53 (275')
R		February 27, 1974	2:30 p.m.			54 (1200')
S		February 27, 1974	2:45 p.m.			58 (375')
T	1	February 27, 1974	3:05 p.m.	75	71	
	2		3:20 p.m.	73	71	
	3	February 28, 1974	1:45 p.m.	73	71	
	4		2:45 p.m.	73	70	
U	1	February 28, 1974	12:45 p.m.	74	68	
	2		4:00 p.m.	73	72	
	3		4:15 p.m.	72	69	
	4		4:30 p.m.	74	70	
V		February 28, 1974	1:00 p.m.			52 (975')

Table 18 (Cont'd)

SUMMARY OF AMBIENT NOISE MEASUREMENTS

Site		Date and Time		Measured Noise Levels (dBA L_{10}) Offset: 30'	60'	Varies*
W		February 28, 1974	3:20 p.m.	74	67	
X		March 1, 1974	9:05 a.m.	70	--	
Y	1	March 1, 1974	11:35 a.m.	73	69	
	2	March 8, 1974	4:45 p.m.	72	69	
	3		5:00 p.m.	74	70	
Z	1	March 5, 1974	4:15 p.m.	72	65	
	2		4:30 p.m.	72	68	
	3		4:45 p.m.	72	67	
	4		4:55 p.m.	71	66	
AZ	1	March 5, 1974	2:30 p.m.	75	72	
	2		2:45 p.m.	74	--	
	3		3:15 p.m.	75	71	
	4		3:35 p.m.	74	70	
BY		March 5, 1974	2:45 p.m.			58 (275')
CX		March 6, 1974	1:20 p.m.			59 (670')
DW		March 6, 1974	1:50 p.m.			52 (2500')
EU	1	March 6, 1974	2:45 p.m.	77	69	
	2		3:00 p.m.	75	69	
	3		3:15 p.m.	77	72	
	4		3:30 p.m.	74	69	
FT	1	March 6, 1974	4:05 p.m.	81	80	
	2		4:30 p.m.	73	75	
GS		March 7, 1974	1:25 p.m.			62 (300')
HR	1	March 7, 1974	2:45 p.m.	71	67	
	2		3:15 p.m.	73	69	
	3		3:45 p.m.	74	72	
	4		4:10 p.m.	75	72	
JQ	1	March 7, 1974	4:40 p.m.	73	68	
	2		4:55 p.m.	73	67	
	3		5:10 p.m.	72	68	
KP	1	March 8, 1974	3:05 p.m.	73	68	
	2		3:30 p.m.	73	69	
	3		4:10 p.m.	73	71	
	4		4:25 p.m.	72	70	
	5	March 12, 1974	3:45 p.m.	71	70	
	6		4:10 p.m.	72	72	
	7		4:35 p.m.	73	72	
LN	1	March 11, 1974	3:55 p.m.	72	66	
	2		4:15 p.m.	71	67	
	3		4:45 p.m.	69	67	

* Distance to heavily traveled roadway shown in parentheses.

f. Noise Level Prediction

As the final step in the noise impact assessment, the future noise levels from the proposed alternatives must be predicted. Noise impacts are determined by comparing predicted levels with both FHWA design noise levels and ambient levels.

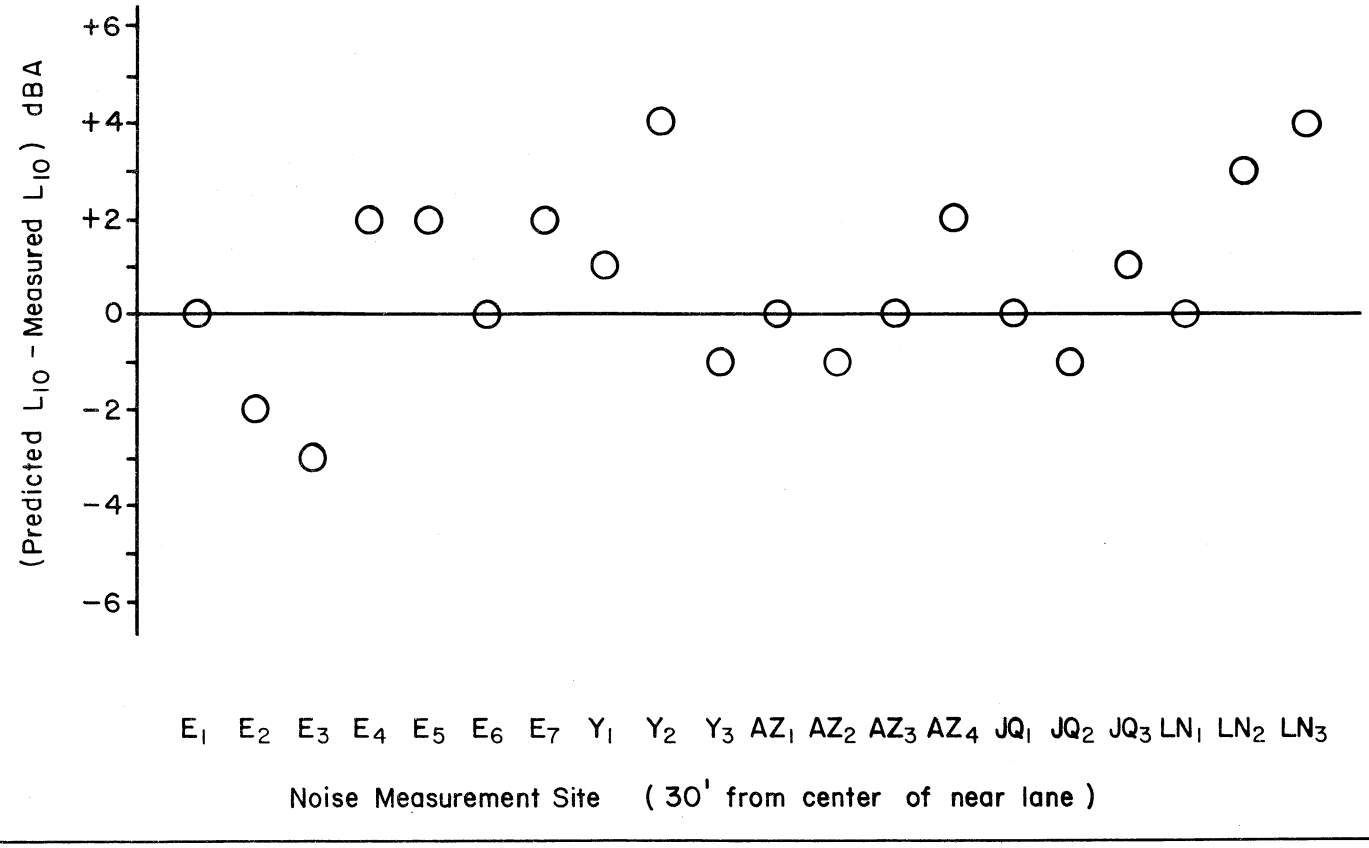
The noise prediction methodology used in this report is Highway Noise: A Design Guide for Highway Engineers (NCHRP Report 117). This prediction model has been approved by the FHWA for use in applying the noise standards. Certain refinements to the model to facilitate evaluation of interchanges were obtained from Fundamentals and Abatement of Highway Traffic Noise, prepared for the FHWA by Bolt Beranek and Newman Inc.

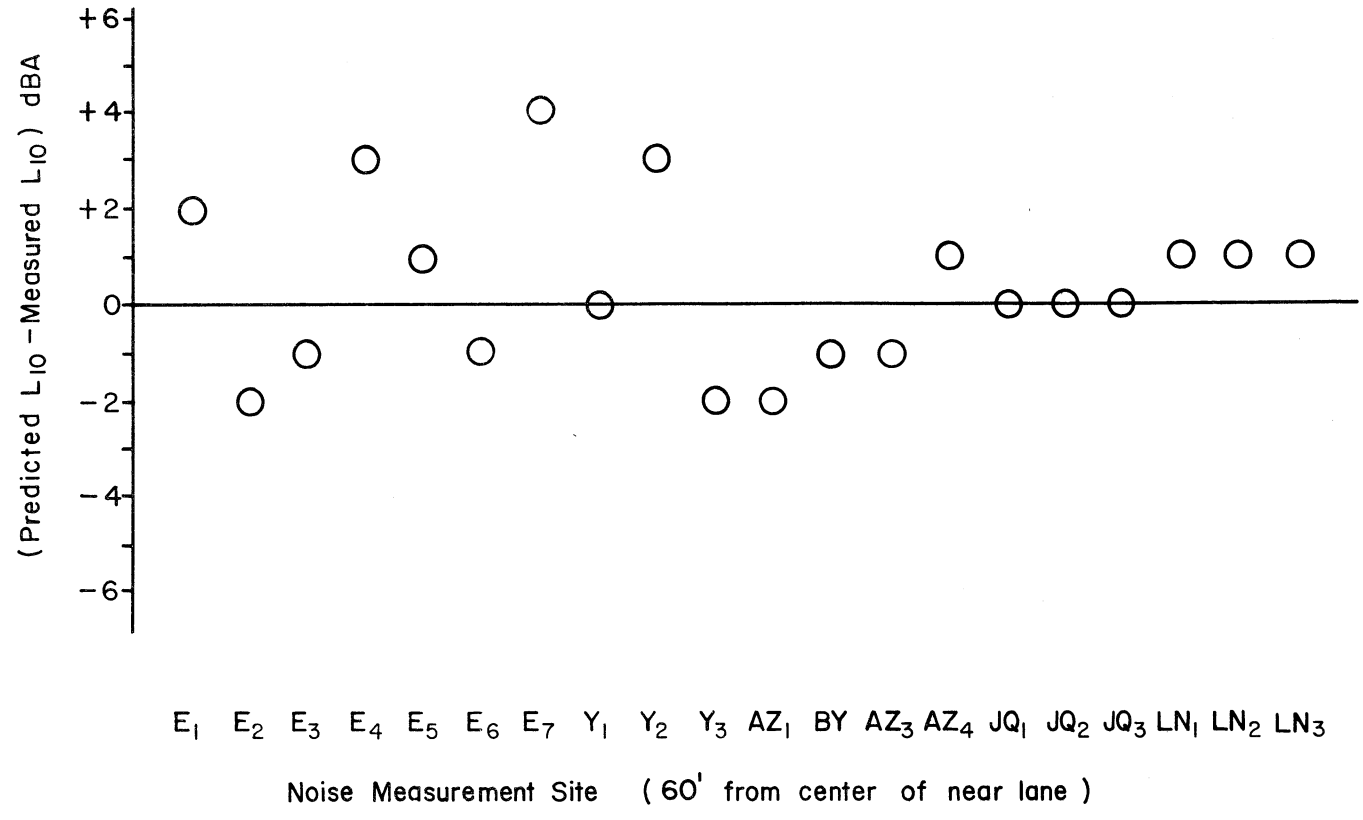
To provide an indication of the accuracy of the model, ambient noise levels were predicted at selected measurement sites. The field measurement data were studied to select a number of sites which provided variations in both traffic volumes and automobile/truck mix. L_{10} noise levels at Sites E, Y, AZ, BY, JQ, and LN were predicted based on traffic volumes, percent heavy-duty trucks and speeds observed during the field measurements. Comparison of predicted L_{10} levels with measured L_{10} levels showed that, at the 30-foot offset measurement locations, the Report 117 method underpredicted by as much as 4 dBA and overpredicted by as much as 3 dBA. At 60 feet, the results were similar, except that the model underpredicted by as much as 5 dBA.

Further analysis of traffic volumes and predicted and measured noise levels showed that, at Site JQ, two data sets were taken which had no truck traffic. The model underpredicted this condition by a maximum of 2 dBA. In consideration of the time of year the field measurements were taken, it appeared reasonable that the predictions would be low since automobiles would have been equipped with regular or studded snow tires. While this type of tire can be significantly noisier than the conventional ribbed tire design, tire noise is generally not a significant contribution to overall automobile noise at the speeds of less than 35 miles-per-hour observed during noise measurements. Based on this data, a +2 dBA adjustment in the predicted noise levels due to automobiles only would give good correlation with measured L_{10} levels for the Report 117 methodology.

Site BY was the only one that was located a substantial distance from a highway and which also had traffic volumes counted during the measurement period. With the +2 dBA adjustment to automobile noise levels, the Report 117 method underpredicted by only 1 dBA. Figure 19 shows a comparison between predicted and measured L_{10} levels. The predicted L_{10} levels used in the comparison include the +2 dBA adjustment for cars.

To evaluate the acoustic impact of the several alternate locations, noise contour maps for 1994 L_{10} noise levels were prepared for Alternates A, B, B-1, and C as well as for 1974 ambient levels. (These maps are shown later in Section IV.D.) Use of the noise contours provides an informative general representation of the noise environment adjacent to the highway. Noise contours are not precisely accurate at every point, but they are approximately accurate everywhere.





MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

ENVIRONMENTAL IMPACT STUDY
WESTBROOK ARTERIAL · WESTBROOK-PORTLAND

Prepared by :
Edwards and Kelcey

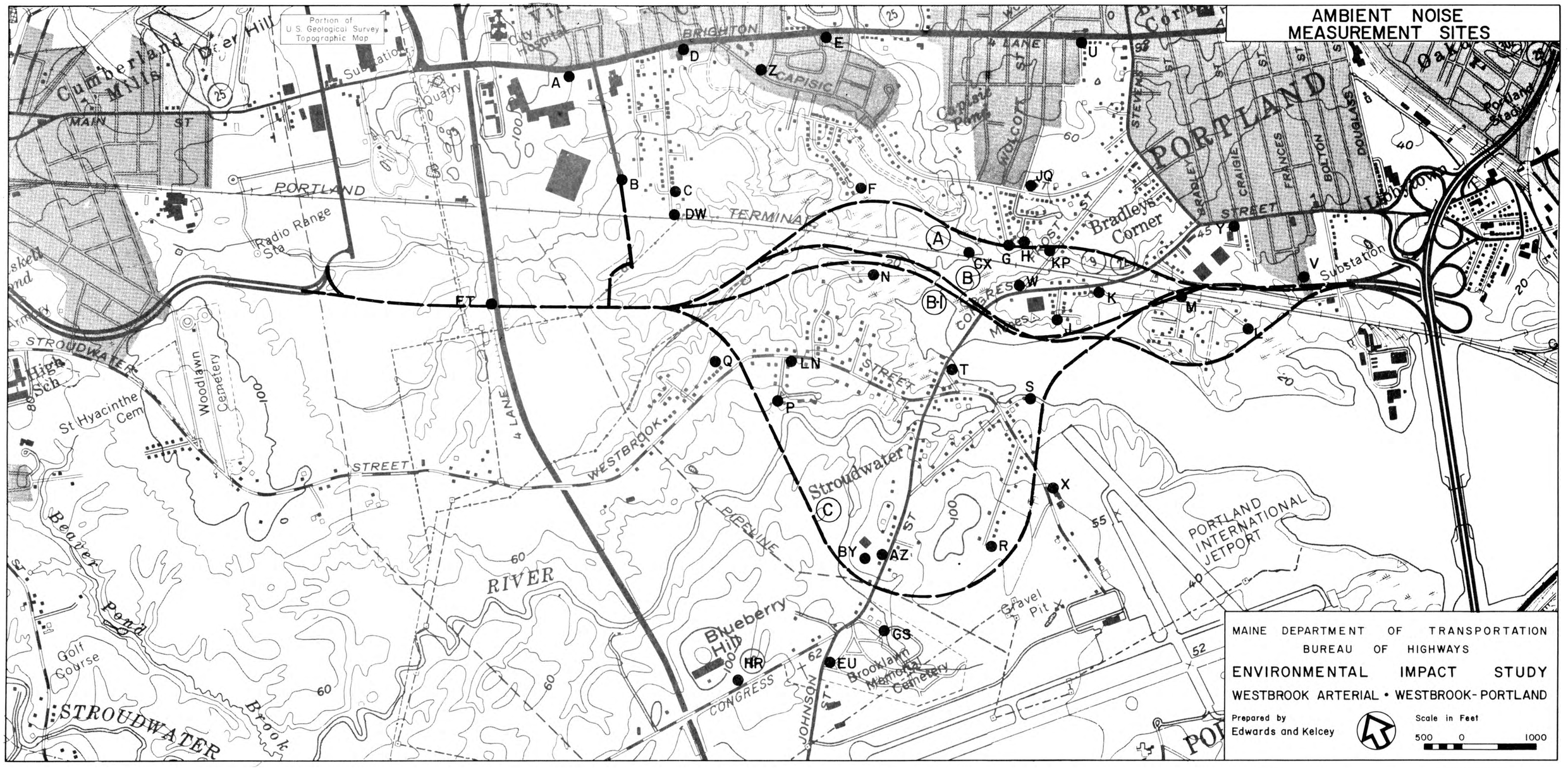
COMPARISON OF PREDICTED AND MEASURED NOISE LEVELS

FIGURE 19

The first step in establishing the noise contours was to predict L_{10} noise levels at several distances from each roadway segment, using projected design hourly volumes and corresponding vehicle operating speeds. The L_{10} levels were then used to draw a graph of noise levels versus distance from the highway. Offsets from the highway to specified L_{10} levels (in this case 5 dBA intervals) were determined by inspection, and used to draw contours on photogrammetric plans of the alternates.

An additional step in the noise impact assessment was to evaluate the effect each of the alternates would have on noise levels adjacent to existing streets in the study area.

The results of the noise impact assessment are presented later, in Section IV.D.


AMBIENT NOISE MEASUREMENT SITES
Portion of U.S. Geological Survey Topographic Map
MAINE DEPARTMENT OF TRANSPORTATION
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Scale in Feet
500 0 1000
Cumberland Mills
Pleasant Hill
MAIN ST
PORTLAND
TERMINAL
Radio Range Sta
City Hospital
BRIGHTON
CAPISIC
Capisic Pond
WOLCOTT
STEVENS
BRADLEY
CRAIGIE
FRANCES
BOLTON
DOUGLASS
STREET
Bradleys Corner
Substation
Quarry
4 LANE
CONGRESS
Mosses
STROUDWATER
High Sch
St Hyacinthe Cem
Woodlawn Cemetery
WESTBROOK
STREET
Stroudwater
PIPELINE
ST
PORTLAND INTERNATIONAL JETPORT
Gravel Pit
Blueberry Hill
Brooklawn Memorial Cemetery
JOHNSON ST
Beaver Pond
Golf Course
STROUDWATER
Brook
RIVER
A
B
C
D
E
F
Z
U
JQ
Y
V
DW
ET
N
G
H
CX
KP
W
K
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LN
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T
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X
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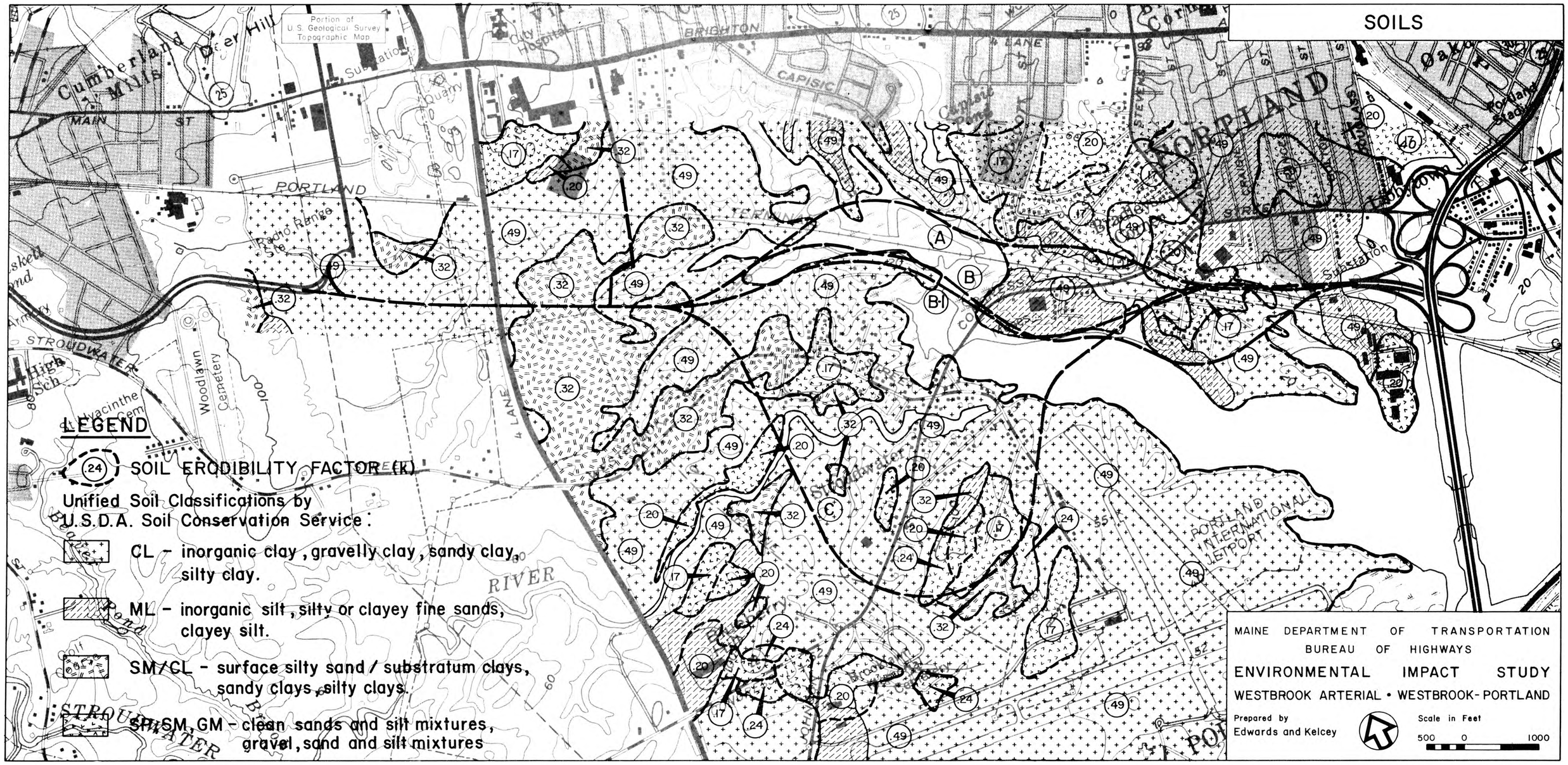
BY
AZ
GS
EU
HR

FIGURE 20


SOILS
Portion of U.S. Geological Survey Topographic Map
LEGEND
(.24) SOIL ERODIBILITY FACTOR (K)
Unified Soil Classifications by U.S.D.A. Soil Conservation Service:
CL - inorganic clay, gravelly clay, sandy clay, silty clay.
ML - inorganic silt, silty or clayey fine sands, clayey silt.
SM/CL - surface silty sand / substratum clays, sandy clays, silty clays.
SP/SM, GM - clean sands and silt mixtures, gravel, sand and silt mixtures
A
B
B-1
C
PORTLAND
STROUDWATER
RIVER
PORTLAND INTERNATIONAL AIRPORT
MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS
ENVIRONMENTAL IMPACT STUDY
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Prepared by Edwards and Kelcey
Scale in Feet
500 0 1000

FIGURE 21

D. THE NATURAL ENVIRONMENT

1. Geology-Soils-Groundwater

a. Surficial Geology

The principal geologic feature of the study area is a semi-continuous bed of marine clays, silts, and fine sands. This bed reaches a thickness of 100 feet in the Fore River channel. These marine deposits resulted from inundation that followed the retreat of the last glacier. These silts and clays are interrupted only when bedrock highs or large deposits of coarser material (glacial till) protrude up through them. In broad high areas between streams, the fine marine sediments are capped by coarser material ranging from fine sands and clayey silts to gravel.

b. Soils

The term soils in this study is intended to mean all the unconsolidated material overlying bedrock. It includes, but is not limited to, altered material on the surface which will support plant growth.

Soil maps from several sources are available for the study area. The Soils Section, Maine Department of Transportation, has prepared an engineering soils map of the area. The U. S. Department of Agriculture's Soil Conservation Service has mapped the area as part of their routine, medium intensity soil mapping program. Both groups have classified the soil by grain size characteristics. Test boring data from over 100 borings made by the Soils Section, Maine D.O.T., were used to correlate on-site conditions with the maps. A close agreement was found between the maps and borings.

The Soil Conservation Service used the Unified Soil Classification System for grain size mapping and provided a soil erodibility factor, K, from the Universal Soil Loss Formula. The combination of these characteristics is shown on Figure 21. The soil erodibility factor K provides a measure of relative erodibility. The smallest numbers indicate the least erodible soil on a scale from .17 to .49. The percentage of the study area covered by soils of each erodibility class (exclusive of marsh and wetlands, which total 25%) is listed below. Areas with no valid data cover less than 0.1%.

.17= 6%
.20= 5%
.24= 1%
.32= 7%
.49= 56%

Very erodible soils cover a majority of the land in the study area. Most of these are the silts and clays of the widespread marine deposits mentioned above.

c. Bedrock

Bedrock seldom surfaces in the study area. The top of bedrock is highly irregular, since it is 100 feet below the Fore River channel but outcrops for limited areas at the Capisic Pond overflow and at the mouth of the Stroudwater River. Bedrock is schists and phyllites striking northeast with bedding and foliation at a moderate southeast dip. Geologists have inferred a minor fault striking northeast across the study area.

d. Groundwater

Groundwater in the area does not provide a major source of water supply. The groundwater table is near the surface during much of the year. Test borings show the water table 3 to 8 feet below surface, which indicates that the widespread marine sediments are almost completely saturated. In most areas groundwater is at or near the surface of the clay. In some cases where granular soils cap depressions in the impermeable clays, shallow groundwater may be perched on the marine sediments. Test borings which penetrate the marine clays indicate that a slight artesian condition may exist in the glacial till where it underlies the clay.

It is possible that old, hand-dug wells may exist in the coarser sediments capping the marine clay. However, a check with State and local agencies confirms that it is very unlikely that wells are being used in lieu of available public water. If future large-yield industrial wells were needed, they would have to tap aquifers below the marine clay. They would be isolated from the effects of this project.

2. Surface Water

The most predominant feature of the study area is the Fore River and its associated wetlands. (Figures 22-24, pages 87-89.) Within the study area, the Fore River and its wetlands occupy an area approximately 2 miles in length extending from the bridge at I-295 west to the upper reaches of the brackish marshland. From I-295 east, the Fore River flows approximately 3.5 miles to Casco Bay.

The portion of the Fore River which is included in the study area is composed of a shallow, narrow channel bounded by tidal flats. Above the Congress Street bridge are typical areas of saltmarsh and saltmeadow grasses (Figures 22 and 23). The results of tests conducted in the Fall of 1973 on samples from 17 water quality sampling stations (Figure 24) in the study area indicate that the water in the Fore River is of questionable value for human use, due to the discharge of untreated sewage directly into the river at 11 different points. High total coliform and fecal coliform levels indicate that disease organisms could be present in large numbers. This condition combined with the presence of toxic materials possibly discharged from the combined sewers, should act as a deterrent to body contact or the consumption of any shellfish, finfish or other wildlife which may be found in the area. With this restriction in mind, however, the remaining water quality parameters indicate that

the river is flushed and "cleaned" by tidal action on a daily basis. Examination of dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD) and nutrient levels provides a profile which points toward a stream which is able to support diverse aquatic life. At present levels the untreated wastes which are discharged into the river are sufficiently diluted and flushed by the tidal waters so as to prevent further serious deterioration of water quality.

Significant fresh water input to the Fore River occurs at five locations. To the north of the Portland Terminal rail line, fresh water enters from two sources. The major input is from Capisic Pond and its associated stream system which drains approximately 1,600 acres west of downtown Portland. Water quality data for the stream (Station 3) entering Capisic Pond indicate that there is some possible contamination from sewage, either from leakage of existing sewer pipes, or from direct discharge at various points. The total coliform level was high, showing a Most Probable Number (MPN) of 61,000 per 100 milliliters (ml), while fecal coliform levels were 560 MPN/100 ml. It does not appear that the 2.6 milligrams per liter (mg/l) of total kjeldahl nitrogen (TKN) or .03 mg/l of phosphorus indicate excessive amounts of these nutrients presently being added to Capisic Pond from this source, but this input is cumulative and these levels are well above minimum concentrations needed for algal blooms. The dissolved oxygen content of this stream at Station 3 was 7.6 parts per million (ppm) which is adequate for the support of aquatic life. A turbidity level of 3 Jackson Turbidity Units (J.T.U.) should not interfere with the photosynthetic processes of aquatic plants.

Water from Capisic Pond enters the upper area of the Fore River estuary by flowing over the top of a dam-sewage overflow structure at the southern terminus of the pond. The water quality of Capisic Pond (Station 4) is relatively low. Total and fecal coliform levels are high (270,000 and 1,600 MPN/100 ml, respectively) and dissolved oxygen registered 4.2 ppm. The color of the water appears brown and turbid although it registered 12 J.T.U. upon testing. A level of 7.8 mg/l of TKN begins to approach a very questionable level, and a total phosphorus level of 0.03 mg/l indicates a severely disrupted Nitrogen/Phosphorus ratio. From visual observation, the pond is in the early stages of eutrophication. This process is enhanced by the fact that suspended matter in the water entering the pond has ample opportunity to settle out before the water exits over the dam. Nutrient levels would also have a tendency to concentrate in the pond and cause heavy algal blooms during the warmer months. A continuation of these processes could ultimately fill the pond and create a fresh water marsh in its place.

Running under Capisic Pond is the 110" West Side combined sewer which enters into the West Side Weir Overflow beneath Capisic dam. The 110" sewer flows into a 30" sewer at this point. This 30" sewer may be sufficient for normal low-flow periods, but its insufficiency for periods of medium to high flow from rainfall is obvious. The sewage overflow discharges into an excavated gorge and flows directly to the Fore River north of the Portland Terminal rail line. The water in this stream (Station 4A) is at times, therefore, a combination of overflow from Capisic Pond and the sewer line below.

A sampling of the waste material in the open sewer line (Station 4B) reveals a low dissolved oxygen content (3.6 ppm), high nutrient levels (16.3 mg/l of TKN and 1.87 mg/l of phosphorus), high turbidity (25 J.T.U.) and extremely high total and fecal coliform levels (6,000,000 MPN/100 ml and 90,000 MPN/100 ml, respectively). One may also assume, from tests done on this material at a different time, that it carries a relatively high chemical and biological oxygen demand. Rapid infusion of this waste material in large volumes during overflow periods can only contribute to the degradation of water quality in the Fore River. During high tide periods, the impact of this waste water may be reduced by dilution; during the lower tidal stages, aquatic organisms which are relatively intolerant and not mobile, could be adversely affected by rapid changes in water quality parameters.

The second fresh water source for the Fore River north of the Portland Terminal rail line is an unnamed stream which constitutes the headwaters of the river. Draining an area of approximately 900 acres, the stream rises west of I-95 and flows easterly through an undeveloped portion of the study area until it passes through the development located at Webb and Rowe avenues.

Two water sampling stations were located in this area: Station 1, before the stream passes through the subdivision, and Station 2, as it emerges from the subdivision. At this point the stream meanders toward the tidal marsh area and becomes part of the Fore River estuary. A third water sampling site (Station 5) was located on this stream where, as a narrow tidal creek, it passes quite close and parallel to the rail line. Water testing results indicated that the water in this stream system is of fairly good quality with adequate dissolved oxygen, low BOD, and low COD parameters. There is some evidence that the stream may be receiving some infiltration of sewage as indicated by the total and fecal coliform counts for Stations 1 and 2. The higher coliform counts for Station 5, at both high and low tide, are probably due to the influence of tidal waters already contaminated from direct sewage discharge before reaching this point. The highly saline nature of the water sampled at Station 5 during low tide periods indicates that this stream contributes little fresh water flow to the Fore River estuary on a daily basis. This source of fresh water should be considered of minor importance except in times of heavy runoff from rain or snowmelt, when fresh water flow would increase substantially.

Sampling Station 6 was established at the location of the two stacked culverts which go under the rail line embankment and provide the passageway for the waters of the Fore River to move north and south of this barrier. Examination of the data taken at high, medium and low tides indicates that chemical and physical parameters of water quality are generally satisfactory but, again, the biological parameters of total and fecal coliform are quite high. The worst condition exists at low tide when this station receives minimally diluted, contaminated waters from the West Side Weir sewage overflow under Capisic Pond. It should also be noted that at low tide this station still reflects a relatively saline condition indicating that there is only a moderate amount of fresh water infusion, primarily from Capisic Pond.

To the south of the railroad bed, but still west of Congress Street, there is a tidal creek (which is essentially the old C&O Canal) which drains some 300 acres of westerly upland area. Analysis of the water quality data collected at Station 7 indicates a situation similar to Station 5. All parameters fall within an acceptable range for this stream with the exception of coliform counts which are excessive. These high counts can be attributed mainly to the discharge of untreated sewage into the Fore River at a location just south of the entrance to this creek. The sewage comes from an 18" sewer line which serves Partridge Road, Stroudwater Road and Roundabout Lane. The high tides dilute the counts to some degree, but at low tides with little fresh water flow from the upland for dilution, the counts get quite high (180,000 MPN/100 ml for total coliform and 3,400 MPN/100 ml for fecal coliform).

In general it can be stated that the water quality upstream of Congress Street is adversely affected by the addition of untreated wastes from two locations. During periods of high runoff the water quality would be substantially decreased as a result of overflow from the West Side Weir and increased quantities of poor quality water from Capisic Pond. The impact of these additions is reduced substantially by the dilution of this material in the tidal waters of the Fore River and the daily flushing action of the tides. It should be noted that, on either a high or low tidal cycle, the coliform counts remain high in this area due to the constant addition of untreated wastes, both in this vicinity and further to the east. Dissolved oxygen seems to be generally acceptable for the waters above Congress Street, and BOD and COD probably remain low during normal runoff periods. The levels of nitrogen and phosphorus seem to be within reasonable limits in the tidal portions of this area, and the nitrogen/phosphorus ratio seems in balance. Severe disruption of this ratio is likely during periods of high runoff from Capisic Pond and the associated sewage overflow. The water is primarily saline with little fresh water input in times of normal runoff. The fresh water inputs are easily delineated and the area north of the railroad line can be considered a mixing zone west of Congress Street.

The Stroudwater River enters the Fore River approximately 1,000' east of Congress Street. This river is the major source of fresh water entering the Fore River estuary. The headwaters of the Stroudwater River arise approximately 10.5 miles to the west of the Fore River and the river drains about 16,000 acres of upland on its way to the confluence of the two rivers. The Stroudwater is dammed just above Westbrook Street and areas below this dam are subject to tidal action. Three sampling stations were established for this area: the first (Station 8) at the dam overflow; the second (Station 9) just below the dam; and the third (Station 10), located at the confluence of the Stroudwater and Fore Rivers. Data collected at Stations 8 and 9 indicate that the waters of the Stroudwater River in the study area fall within the parameters of Class C, which is the designation for this river from Indian Camp Brook to the dam at Westbrook Street. There is treated sewage effluent discharging into the Stroudwater at a point west of I-95, but it seems that the river is able to purify itself through natural processes; and there is little evidence of heavy pollution when the river reaches the Fore River. Relatively low dissolved oxygen readings at the dam (5.0 and 5.4 ppm with H_2O temperature

of 12 and 13°C, respectively) indicate a possible oxygen loss. However, significant reaeration takes place as the waters flow over the dam and across the rip-rap placed below the dam. Measurements of dissolved oxygen at this location indicated 9.9 ppm after the water passed this area. As this well-oxygenated water reaches the Fore River waters, especially on early incoming and late outgoing tides, a decrease can be expected in the dissolved oxygen level due to mixing. However, the fresh water from the Stroudwater River should not detract from the water quality of the Fore River, and, in fact, probably improves it through mixing and dilution.

The last major source of fresh water input to the Fore River estuary is Long Creek. This stream drains 11,800 acres, primarily in South Portland. Water samples taken here (Station 15) indicate high levels of total and fecal coliform (26,000 MPN/100 ml and 580 MPN/100 ml, respectively) during lower tidal stages, with significant dilution occurring during higher tides. The dissolved oxygen level during lower tidal stages was measured at 5.7 ppm while during higher stages this level was 6.9 ppm. Sewage outfalls (42" and 30") from South Portland discharge effluent in the vicinity of Long Creek as it enters the Fore River, and this may be responsible for the relatively poor water quality found in this area during lower tides.

Untreated sewage discharged into the Fore River is the major factor contributing to long-term water quality degradation. The constantly flowing 30" combined sewage outfall (Station 11), located on the north side of the Fore River approximately 2,400 feet east of the Congress Street bridge is a major pollution factor on the river. It contributes significant biological (82 mg/l) and chemical (64 mg/l) oxygen demand and huge total (20,000,000 MPN/100 ml) and fecal (160,000 MPN/100 ml) coliform levels. The nutrient values for nitrogen and phosphorus are high, while turbidity and organic solids are at significant levels in relation to the rest of the area.

Untreated sewage is also discharged at Stations 12 and 13 on either side of Thompson's Point. The volume of these discharges is not as significant as are discharges elsewhere on the river; however, they do add incrementally to the pollution levels detected in the Fore River study area.

At the present time the Fore River is classified as SC according to Maine Statutes, Title 38, Chapter 2, Section 364 (Classification of Tidal or Marine Water). This standard requires that the following criteria not be violated:

> "Class SC, the 4th highest classification, shall be of such quality as to be satisfactory for recreational boating, fishing and other similar uses except primary water contact. Such waters may be used for the propagation of indigenous shellfish to be harvested for depuration purposes, for a fish and wildlife habitat, and for industrial cooling and process uses. The dissolved oxygen content of such waters shall not be less than 5 parts per million at any time. The median numbers of coliform bacteria in any series of samples representative of waters in the shellfish growing area shall not be in excess of 700 per 100 milliliters, nor shall more than 10% of the samples exceed 2,300 coliform bacteria per 100 milliliters. The median numbers of fecal coliform bacteria in any series of

sample representative of waters in the shellfish growing area shall not be in excess of 150 per 100 milliliters, nor shall more than 10% of the samples exceed 500 coliform bacteria per 100 milliliters. In a non-shellfish growing area, the median number of a series of samples representative of the waters shall not exceed 1,500 per 100 milliliters, nor shall more than 10% of the samples exceed 5,000 per 100 milliliters.

"In a non-shellfish growing area the median numbers of fecal coliform bacteria in a series of samples representative of the waters shall not exceed 300 per 100 milliliters, nor shall more than 10% of the samples exceed 1,000 fecal coliform bacteria per 100 milliliters.

"There shall be no floating solids, settleable solids, oil or sludge deposits attributable to sewage, industrial wastes or other wastes, and no deposit of garbage, cinders, ashes, oils, sludge or other refuse. There shall be no discharge of sewage or other wastes, except those which have received treatment for the adequate removal of waste constituents including, but not limited to, solids, color, turbidity, taste, odor or toxic materials, such that these treated wastes will not lower the standards or alter the usages of this classification, nor shall such disposal of sewage or waste be injurious to aquatic life or render such dangerous for human consumption.

"There shall be no toxic wastes, deleterious substances, colored or other wastes or heated liquids discharged to waters of this classification either singly or in combinations with other substances or wastes in such amounts or at such temperatures as to be injurious to edible fish or shellfish or to the culture or propagation thereof, or which in any manner shall adversely affect the flavor, color, or odor thereof or impair the waters for any other usage ascribed to waters of this classification. There shall be no waste discharge which will cause the hydrogen-ion concentration or "pH" of the receiving waters to fall outside the 6.7 to 8.5 range. There shall be no disposal of any matter or substance that contains chemical constituents which are harmful to humans, animal or aquatic life or which adversely affects any other water use in this class. No radioactive matter or substance shall be permitted in these waters which would be harmful to humans, animal or aquatic life and there shall be no disposal of any matter or substance which would result in radio-nuclide concentrations in edible fish or other aquatic life thereby rendering them dangerous for human consumption."

Observations at 17 water quality and 10 sediment testing stations indicate violation of the above standards in the following areas:

Total coliform bacteria exceed allowable limits for non-shellfish areas. (Fore River closed to shellfishing.)

Total fecal coliform bacteria exceed allowable limits for non-shellfish areas. (Fore River closed to shellfishing.)

There are observable floating solids, settleable solids, oil and sludge deposits attributable to sewage, industrial wastes or other wastes in the Fore River.

There is discharge of non-treated sewage into the Fore River at 11 points. (See Figure 14 on page 44.)

The disposal of sewage and waste are injurious to aquatic life and render such dangerous for human consumption.

There are toxic wastes, deleterious substances and other wastes being discharged into the Fore River which either singly or in combination with other substances adversely affect the flavor, color, and odor thereof and impair the waters of the Fore River for usage ascribed to Class SC waters.

There is disposal of matter that contains chemical constituents which are harmful to humans, animal, or aquatic life or which adversely affect any other water use in this class.

Most of these violations of Maine water standards should be corrected as soon as the City of Portland implements the proposed sewage system. This system is designed to eliminate discharge into the Fore River by provision of interceptor sewers which will carry the effluent to a treatment plant located east of Back Cove. Once the sewage discharge problem is eliminated in the Fore River, and time for recovery is allowed, water quality should return to a level which would allow for an upgrading of the river's classification and human body contact should again be permissable.

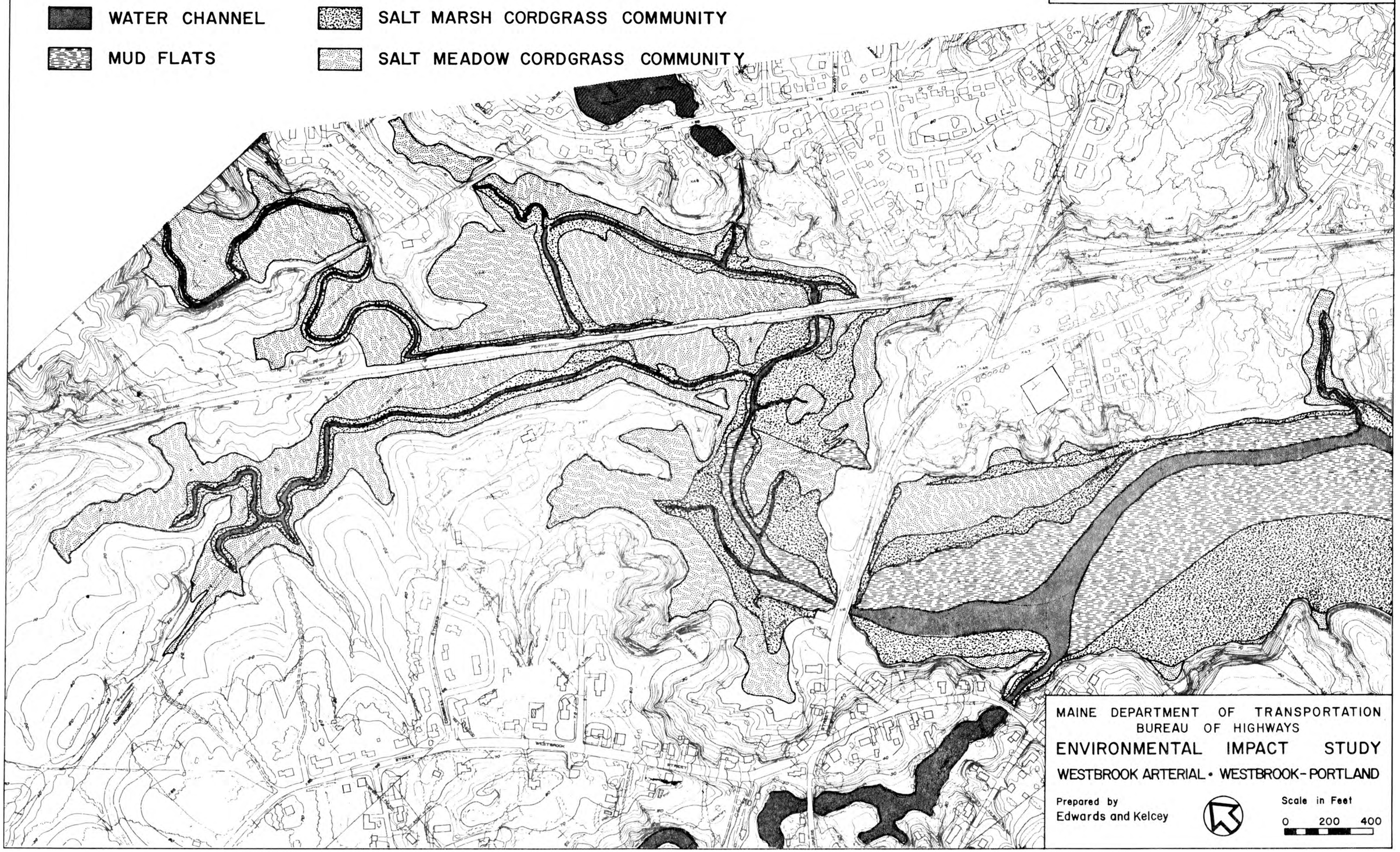
Due to the presence of untreated sewage being released into the estuary at 11 locations, it was determined that sediment examinations should be conducted to detect the presence and concentrations of expected heavy metals. Ten-foot core samples were taken at 13 stations (Figure 24) and tested by standard methods for mercury, lead and zinc. The results of this analysis revealed that the Federally specified maximum level for the presence of mercury permissible in dredged material for ocean disposal was violated at one station. This violation occurred for mercury at station 4 which revealed 1.1 ppm on a dry weight basis. The level of mercury permitted under Federal Regulation for ocean disposal is 0.75 ppm. None of the other stations violated this permissable level.

If ocean dumping was chosen as the method of disposal for dredged material, a sample of the water at the disposal area would have to be analyzed and compared to results obtained from "shaker tests" performed on the spoil. Allowable limits for controlled substances would be restricted to concentrations 1.5 times those of the water at the disposal area.

WETLANDS

LEGEND

- WATER CHANNEL
- MUD FLATS
- SALT MARSH CORDGRASS COMMUNITY
- SALT MEADOW CORDGRASS COMMUNITY



MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

ENVIRONMENTAL IMPACT STUDY

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Edwards and Kelcey

Scale in Feet
0 200 400

FIGURE 22

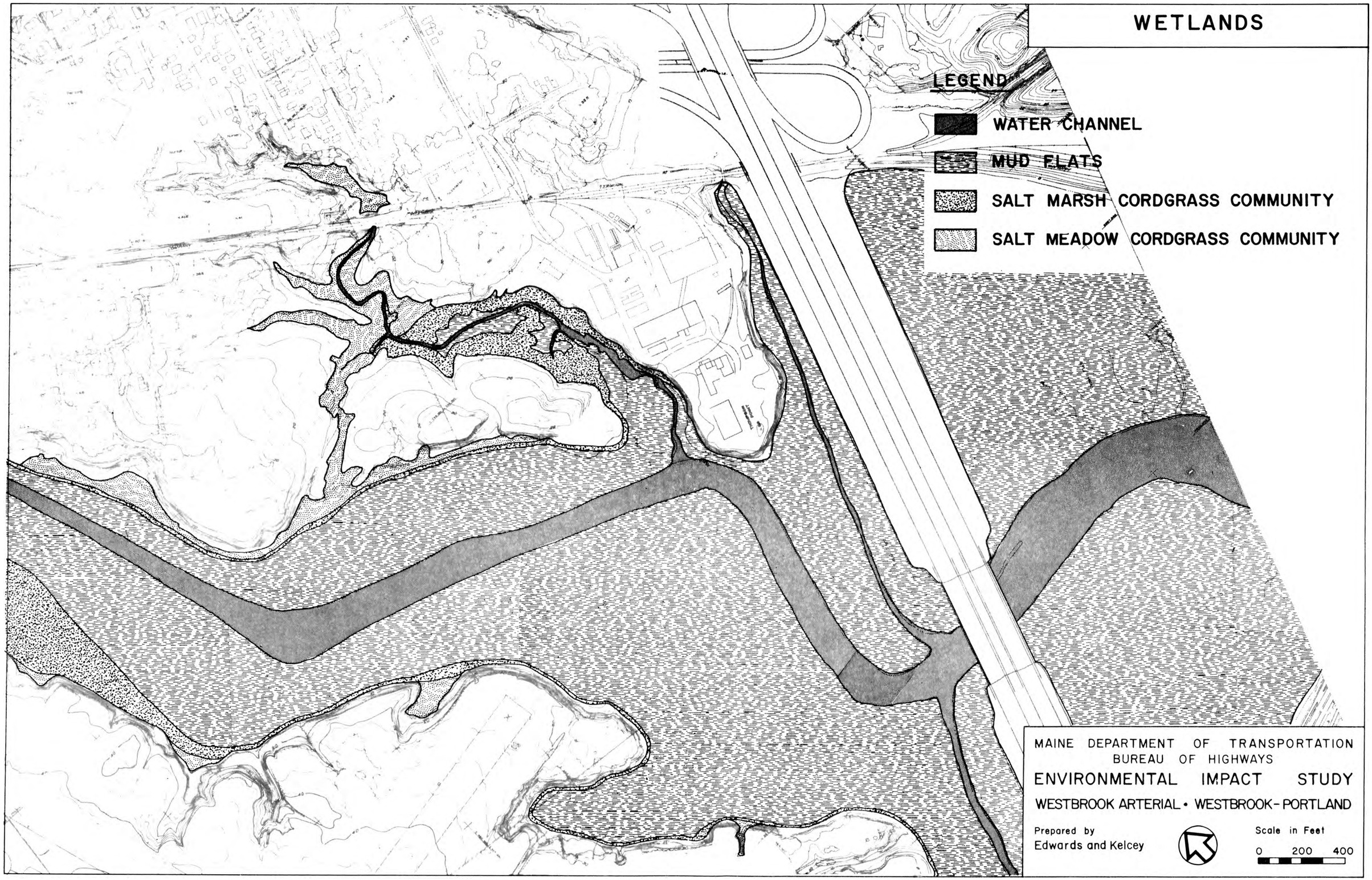
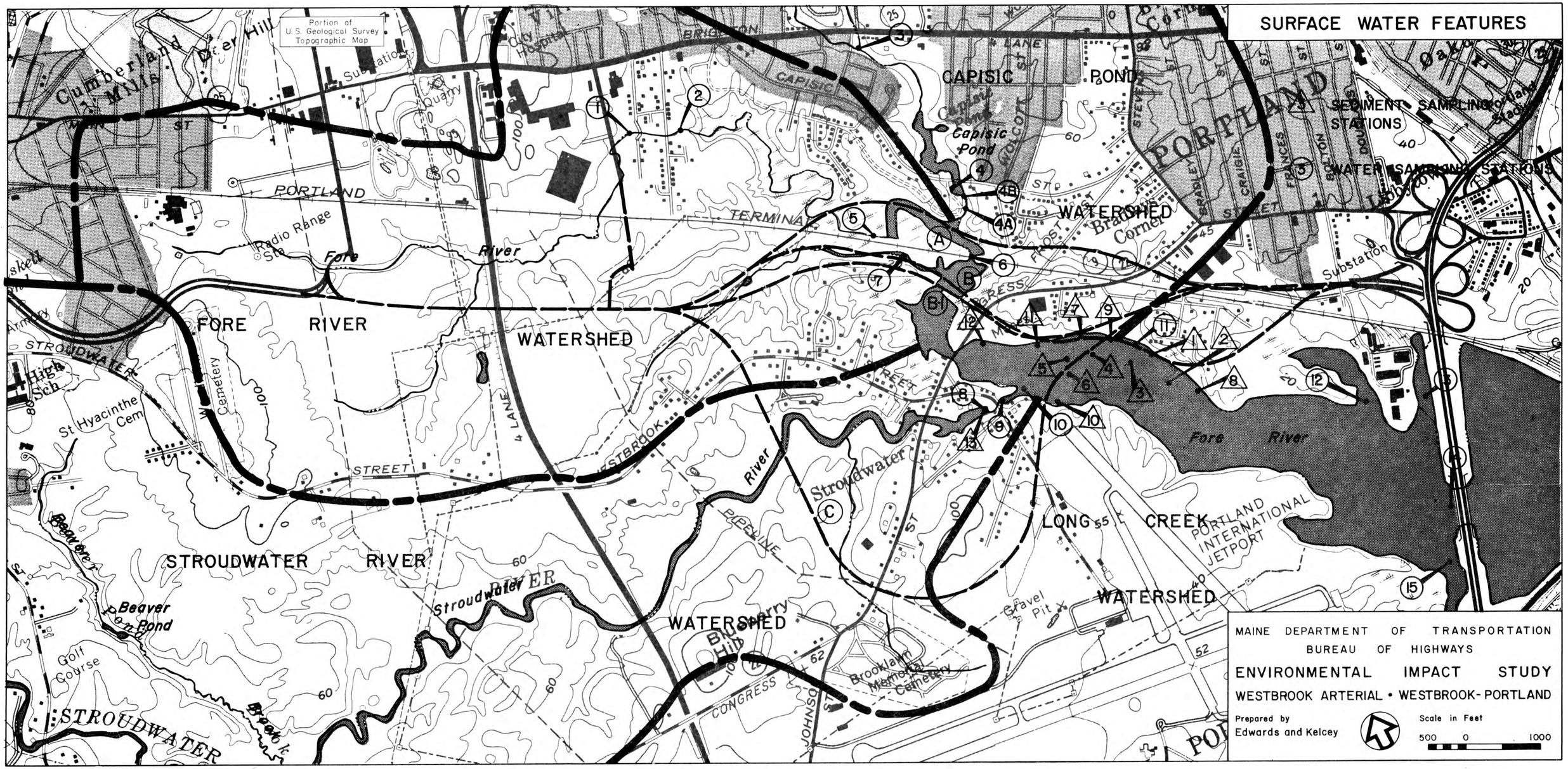

WETLANDS
LEGEND
WATER CHANNEL
MUD FLATS
SALT MARSH CORDGRASS COMMUNITY
SALT MEADOW CORDGRASS COMMUNITY
MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS
ENVIRONMENTAL IMPACT STUDY
WESTBROOK ARTERIAL • WESTBROOK-PORTLAND
Prepared by
Edwards and Kelcey
Scale in Feet
0 200 400

FIGURE 23


SURFACE WATER FEATURES
Portion of U.S. Geological Survey Topographic Map
SEDIMENT SAMPLING STATIONS
WATER SAMPLING STATIONS
FORE RIVER WATERSHED
STROUDWATER RIVER WATERSHED
LONG CREEK WATERSHED
CAPISIC POND
Capisic Pond
Fore River
Stroudwater River
Beaver Pond
Brook
PORTLAND INTERNATIONAL JETPORT
Brooklawn Memorial Cemetery
Gravel Pit
Golf Course
St Hyacinthe Cem
Cemetery
Radio Range Sta
Substation
City Hospital
PORTLAND TERMINAL
WESTBROOK STREET
CONGRESS ST
4 LANE
PIPELINE
MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS
ENVIRONMENTAL IMPACT STUDY
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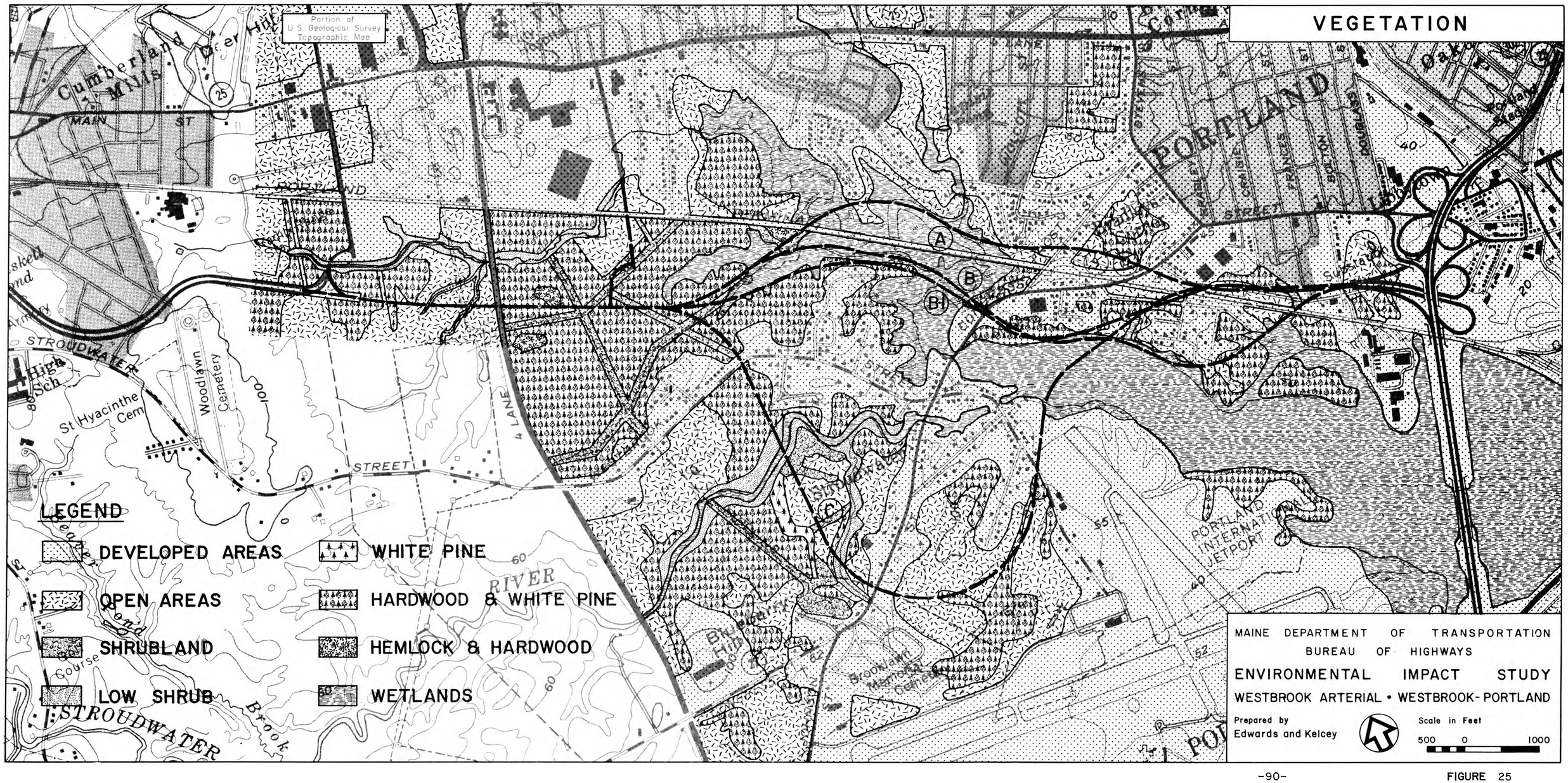
Prepared by
Edwards and Kelcey
Scale in Feet
500 0 1000

FIGURE 24


VEGETATION
Portion of U.S. Geological Survey Topographic Map
LEGEND
DEVELOPED AREAS
OPEN AREAS
SHRUBLAND
LOW SHRUB
WHITE PINE
HARDWOOD & WHITE PINE
HEMLOCK & HARDWOOD
WETLANDS
MAINE DEPARTMENT OF TRANSPORTATION
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ENVIRONMENTAL IMPACT STUDY
WESTBROOK ARTERIAL • WESTBROOK-PORTLAND
Prepared by
Edwards and Kelcey
Scale in Feet
500 0 1000
Cumberland Mills
MAIN ST
PORTLAND
STROUDWATER
STREET
Woodlawn Cemetery
St Hyacinthe Cem
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PORTLAND INTERNATIONAL JETPORT
Brookwood Memorial Gardens

FIGURE 25

3. Vegetation

The vegetation within the study area is composed of several different vegetative communities which give the landscape a highly diverse character. Table 19 presents a breakdown of the vegetative diversity. Much of this diversity can be attributed to man's interference with the natural successional process. These vegetative communities are described below and delineated on Figure 25, page 90.

Table 19

VEGETATIVE COVER - WESTBROOK ARTERIAL STUDY AREA

Vegetative Communities	No. of Acres	% of Total Vegetation of Study Area
Hardwood-White Pine	403	43.1
Open Area	322	34.5
Regularly Flooded Saltmarsh	56	6.0
Coastal Saltmeadow	76	8.1
Shrubland	53	5.7
Low Shrub and Woodland	20	2.1
White Pine	3	0.3
Hemlock-Hardwood	2	0.2
Totals	935	100.0

a. Description of Vegetative Communities

Hardwood-White Pine

There are approximately 403 acres of hardwood-white pine in the study area. This community comprises 50.2% of the upland vegetation and 43.1% of a total vegetative cover of 935 acres.

A common upland forest type, this hardwood-white pine community is widespread in the State of Maine as well as in the study area. The principle species that make up this stand are red oak (Quercus rubra), sugar maple (Acer saccharum), and white pine (Pinus strobus). The oak and maple species predominate, but the pine is widely distributed throughout the community and it predominates in some areas.

There are thirteen other tree species, primarily deciduous, which occur as a part of this vegetative mix, with gray birch (Betula populifolia), green ash (Fraxinus pennsylvanica), american elm (Ulmus americana), and american beech (Fagus grandifolia) being the most frequent.

Beneath the overstory, and intermixed with the smaller individuals of that overstory, are found the predominant shrub species of aromatic wintergreen (Gaultheria procumbens), and late lowbush blueberry (Vaccinium angustifolium). These vegetative layers provide for a somewhat dense vertical and horizontal barrier to humans, for both sight and passage. They are responsible, along with small overstory individuals, for the filling-in of vegetation beneath the taller, more mature trees.

Closer to the ground is found a vegetative layer composed primarily of 12 species of ferns, mosses, and wildflowers. These species make up the major ground cover over the leaf litter and soil, and provide the third readily observable vertical and horizontal strata in this forest type.

Open Areas

Open areas, containing primarily herbaceous plants, occupy approximately 322 acres of the study area, and account for 34.5% of the total vegetative cover and 40.1% of the upland vegetation. A number of smaller vegetative units exist within this larger category of open area, and in many cases these species groups depend on the previous land use and/or maintenance afforded the particular portion being observed. In grass areas, bluegrass (Poa protensis) and quack of witch grass (Agropyron repens) predominate with milkweed (Asclepias syriaca) being conspicuous. In abandoned agricultural areas pigweed (Amaranthus albus), foxtail grass (Setaria spp.), ragweed (Ambrosia artemisiifolia), smartweeds (Polygonum lapathifolium and Polygonum persicaria) and quack of witch grass are predominant ground cover species, while in a recently bulldozed area sweetclover (Melilotus alba) is a uniform cover type. Species mix will also differ when considering the open areas that are maintained as part of lawns associated with residences, businesses, park lands, etc. However, in areas where little or no maintenance takes place, there is the encroachment of woody shrubs into the open areas as natural succession begins. Sixty species were identified in this open space community.

Regularly Flooded Saltmarsh and Coastal Saltmeadow

Covering approximately 132 acres of the Fore River wetlands, this community represents about 13.8% of the vegetation in the study area. This community, shown on Figure 25 as wetlands, can be subdivided into two parts.

The regularly flooded saltmarsh (56 acres) portion is made up primarily of algae and three higher plant species. The predominant, and most important, is saltmarsh cordgrass (Spartina alterniflora). This species exists in zones of daily tidal inundation along the main channel and tidal creeks (Figures 22 and 23). In the upper reaches of the marsh above Congress Street, there are submerged growths of widgeongrass (Ruppia maritima) and dwarfed spikerush

Eleocharis parvula) growing on the sides and bottoms of the tidal creeks and in tidal pools.

Various algal species are interspersed on the tidal flats, tidal creek channels, tidal pools, and in among the saltmarsh cordgrass. Present are various species of brown algae (Phaephuta), green algae (Chlorophyta), blue-green algae (Cyanophyceae), diatoms (Bacillarophyceae), and dinoflagellates (Dinoflagellata).

In the higher marsh zones that are not subject to daily tidal submergence, one finds the coastal saltmeadow (76 acres) portion of the community. This vegetative stand is subject to submergence in saline waters during times of higher than normal tidal action. The most predominant species of this group is saltmeadow cordgrass (Spartina patens). This species covers the higher tidal marsh with a thick layer of vegetation, which is flattened and whorled in a fashion resembling "cowlicks". Due to the fact that this area is less subject to tidal flooding, the number of higher plant species found here is greater than in the saltmarsh zone. Seventeen of these plant species were identified with black grass (Juncus gerardi), sea lavender (Limonium nashii), glasswort (Salicornia europaa), cattails (Typha spp.), saltmarsh sedge (Carex paleacea), and alkali bulrush (Scirpus paludosus) being the most common. In the higher portions of this zone prairie cordgrass (Spartina pectinata) and seaside goldenrod (Solidago sempervirens) are common.

Shrubland

Covering an area of 53 acres this community represents 5.7% of the vegetation in the total study area and 6.6% of the upland cover types. This diverse group of vegetative species contains a number of shrub types which have encroached into previously open areas populated by herbaceous species. Here is found an easily observable stratified situation with the overstory composed of viburnums (Viburnum spp.), red-osier dogwood (Cornus stolonifera), black alder (Ilex certicillata), mountain ash (Pyrus americana), sweet fern (Comptonia peregrina) and late lowbush blueberry, with an understory species predominantly aromatic wintergreen, creeping snowberry (Gaultheria hispidula), bunchberry (Cornus canadensis), bracken fern (Pteridium aquilinum), and sensitive fern (Onoclea sensibilis).

Man's interference with natural succession is evident here, also, as the areas in the utility rights-of-way are kept from progressing from this shrubland community to the more mature hardwood-white pine forest.

Low Shrub and Woodlands

Located primarily along the Stroudwater River and its tributaries this community covers approximately 20 acres. This represents 2.1% of the vegetation in the area, and 2.5% of the upland vegetation. Composed of primarily tag alder (alnus rogosa), willow (Salix spp.) and red maple (Acer rubrum), this stand has a spotty understory dominated by jewelweed (Impatiens capensis) and tearthumb (Polygonum sagittatum), with five other species being occasionally represented.

White Pine

A stand of white pine, located between the Stroudwater River and Congress Street, has such a dense crown cover that it prevents the growth of understory beneath it. Providing easy access to humans, this stand covers approximately 3 acres which represents only 0.3% of the total and 0.4% of the upland vegetation.

Hemlock-Hardwood

Although individual hemlock (Tsuga canadensis) exist throughout the upland forest, it seems to be a dominant species in only a few sites. The 2 acres of this community represent only 0.2% of the total and upland vegetation. This stand provides a very dense crown cover and understory growth is limited to sparse growth of creeping snowberry and club mosses (Lycopodium spp.). Red oak, sugar maple and red maple are interspersed among the hemlocks, but provide little diversity in the stand.

b. Distribution and Diversity of Vegetative Communities

The area to the west of Congress Street and to the north of Westbrook Street is the most vegetatively diverse section of the study area. It contains the largest portion of hardwood-white pine (218 acres), the largest portion of shrubland (34 acres), the largest portion of the saltmarsh-saltmeadow community (81 acres), significant open area (77 acres), two small areas of hemlock-hardwood (2 acres), and a portion of the low shrub community (4 acres).

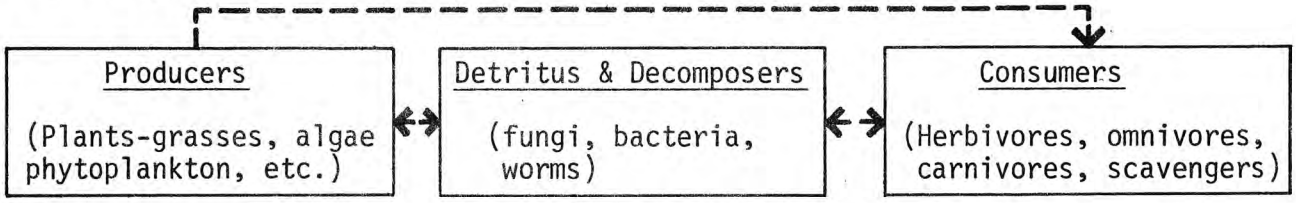
The large hardwood-white pine stand extends east from I-95 to the Fore River saltmarsh and is traversed in five different places by utility rights-of-way overgrown with shrub growth. To the northwest a finger-like projection of low shrub growth extends into this area east from I-95 for about 1,000 feet. This growth is along the headwaters of the Fore River. The two small areas of hemlock-hardwood occur to the west on either side of the major power line right-of-way. The site has open areas primarily to the northwest on either side of the Portland Terminal railroad bed and it is bordered on the south by developed land on Westbrook Street.

The importance of the upland vegetation is in its diversity and spatial arrangement. A large block of hardwood-white pine criss-crossed by shrubland, low shrub, and bordered by saltmarshes and open areas provides for a valuable wildlife habitat in terms of food, water, cover, reproduction, and sufficient acreage to establish home range. The area offers a wide variety of "edge" conditions along with substantial sized blocks of heterogeneous vegetative communities, which serve to attract diverse wildlife groups.

This subsection of the study area also contains the largest portion of the saltmarsh (39%)-saltmeadow cordgrass (78%) community in the study area. This 81-acre parcel extends from Congress Street west for a distance of about 4,300 feet. These wetlands contain very lush growths of the dominant Spartina alterniflora (22 acres) and Spartina patens (59 acres) grasses. The importance

of these and other marsh grasses revolves around the production of vegetable matter for detritus.

As the marsh grasses die and are broken up into smaller and smaller particles, either by physical means or by the decomposing action of bacteria, they, along with the associated bacteria, become detritus. This detritus in conjunction with other decomposers forms the basis for the food web in the saltmarsh community. The following diagram illustrates this process.



It has been estimated (Teal, 1962; Stowe, 1971; Valliea, 1974) that approximately 50% of the vegetative production of these grasses is consumed in the marsh itself. This occurs through some direct feeding by organisms on the living grasses and also by the consumption of the decaying grasses by other organisms. These herbivores are then consumed by other animals thereby contributing energy to a more direct food chain. The remaining 50% of the vegetative mass from these grasses makes its way into tidal waters of the estuary. As this material moves with the ebb and flow of the tides, a portion of it is consumed as detritus by the animals that live in these waters; another portion is decayed completely and contributes nutrient salts to the food web; and still another portion is washed out of the estuary into Casco Bay where it is consumed by organisms residing there. This Casco Bay contribution is supplemented by other tidal wetlands in or adjacent to the Bay. According to the Maine Department of Inland Fisheries and Game there are approximately 916 acres of total wetlands which would contribute a portion of their production to the Casco Bay food web.

The two plant species do not contribute to annual production in the same fashion. The above-ground portion of the S. alterniflora has a brittle, fragile structure which has a tendency to break off close to the marsh surface when covered with ice and snow during winter months. This allows for most of the above-ground plant matter to be contributed directly to the tidal waters of the estuary. The more resiliant and flexible structure of S. patens has a tendency to bend at a weak point in its base, and as a result, forms a spongy mat-like cover over the surface of the mud. This cover is protected from the direct water currents and is not swept into tidal channels and creeks directly, but instead tends to die and decay in place. Some of this material is then moved into tidal waters during the monthly spring tides. In this sense S. patens takes a more indirect route in contributing its vegetative mass to the tidal waters.

Samples of each of the Spartina species were taken at the end of the 1973 growing season in an attempt to determine the potential productivity of the

standing crop. The 18 random, square-foot samples included all above-ground growth and were clipped, dried and weighed with the following results:

	Ounces/Sq. Ft. Standing Crop	Tons/Acre Standing Crop	Total Tons - Study Area Standing Crop
S. patens	7.3	10.0	760
S. alterniflora	3.0	4.1	230

It should be noted that these figures do not represent the total annual Spartina contributed to the food webs of the Fore River and Casco Bay, but just that biomass contribution remaining at the end of the growing season. A portion of this biomass had already been lost or consumed during the growing season.

If one considers the total S. alterniflora acreage for the entire study area, there is a contribution of approximately 230 tons of vegetative mass annually with 115 tons of this enriching tidal waters each year. The production from the S. patens standing crop is 760 tons of vegetative mass with 380 tons contributed to tidal waters.

A comparison of tons/acre from standing crops of S. alterniflora and S. patens produced in the Fore River and other estuaries reveals that the Fore River rates as a highly productive area in this regard.

Area	Reference	S. alterniflora	S. patens
Fore River-Maine		4.1 tons/acre	10.0 tons/acre
Cousins River-Maine	Niering (1971)	3.7 tons/acre	7.8 tons/acre
Cottrell-Conn.	Steever (1969)	3.4 tons/acre	---
Barn Island-Conn.	Gross (1966)	2.2 tons/acre	---

This substantial growth in the Fore River estuary is due in part to the addition of raw sewage into the river by the city of Portland. This sewage provides added nutrients to the marsh ecosystem in the various forms of nitrogen and phosphorus. In Studies of Marine Estuarine Ecosystems Developing With Treated Sewage Wastes, (Odum et. al., 1970) it was found that the growth of Spartina grasses receiving sewage wastes exceeded the growth of the same grasses not receiving such wastes. The biomass the Spartina grasses attain during growth is a function of the nutrient levels available. Nutrients are a limiting factor in the growth process. In areas receiving no additional nutrients from sewage, the S. patens growth on the high marsh may be limited by the availibility of required nutrients. This is due to the fact that the high marsh is inundated far less frequently than the lower S. alterniflora, and therefore, has less opportunity for contact with the available nutrients in the water. Also, the water that does become available to the S. patens has already had some nutrient removal performed by the S. alterniflora. In addition, the high marsh area may have some of the available nutrients leached from the soil by rainfall. Under these conditions the S. alterniflora has the daily opportunity to acquire nutrients for growth while the S. patens is more limited by its higher marsh location.

In the marsh receiving sewage effluent, the situation is somewhat different. The waters which bathe the S. alterniflora and S. patens are richer in nutrient content. The S. alterniflora, being in daily contact with the rich source of nutrients, shows a growth pattern which results in a greater biomass. The water that does reach the high marsh would still be rich in nutrients, even after passing the S. alterniflora. This would provide the needed nutrients to the S. patens thus allowing increased growth over the normal level. This is apparently the reason for the existence of the more productive saltmarsh grasses of the Fore River. The addition of sewage from eleven point sources (Figure 14) occurs both east and west of Congress Street. Nutrients reach the S. alterniflora on a twice daily basis while reaching the S. patens on the higher spring tides, which occur twice monthly, during the new and full moon stages of the lunar cycle. In the Fore River area above Congress Street, one can also expect a longer time period of inundation for both S. patens and S. alterniflora when a heavy rainfall or snow melt coincides with the high tide. This is due to the significantly increased runoff from Capisic Pond and the West Side Weir sewage overflow structure. During these high runoff periods, the increased fresh water input in combination with high tide would probably be sufficient to overload the existing culverts under the Portland Terminal rail line. This overloaded condition would result in a longer retention time for water covering the Spartina grasses, which in turn would result in greater nutrient exchange between the water and the grasses. If this occurs often enough during the year then the impact on the growth of grasses in this vicinity could be quite significant.

The absorbtive capacity of the Spartina grasses in relation to inorganic nutrients introduced into the Fore River must also be considered beneficial in that these grasses do provide a "free" waste treatment function that is usually accomplished only by the complicated and expensive technological processes called tertiary or third stage treatment. The reduction of these nutrient concentrations by the grasses helps to alleviate the potential overgrowth of nuisance plant and animal organisms which tend to shift a diverse estuarine situation to one which is less diverse and therefore less stable in an ecological sense. It should be pointed out that the sewage entering the Fore River has received no treatment. This reduces the efficiency with which the grasses can absorb nutrients by overloading the system with organic matter. The grasses would be much more efficient in reducing nutrient levels if the organic load had been reduced by a secondary sewage treatment process.

From its 22-acre standing crop, the S. alterniflora grasses west of Congress Street would contribute approximately 90 tons per year of vegetable material to the food web in the Fore River estuary while the S. patens would contribute about 590 tons from its 59-acre standing crop. As noted earlier, approximately 50% of this biomass would be consumed in the marshes and 50% would be washed into the tidal waters, with a portion eventually reaching Casco Bay.

The area between Congress Street and I-295 is dominated by the Fore River tidal flats and channel. The northerly side of the channel is bordered by a narrow band of S. alterniflora and to the rear of that on the higher marsh there are areas of S. patens (Figures 22 and 23). The acreages of S. alterniflora and S. patens on this side of the channel from Congress Street to I-295

are 11 and 14 acres, respectively. This represents 20% of the available S. alterniflora and 18% of the available S. patens in the Fore River. This would mean an annual contribution from the standing crop to the food web of 45 tons of S. alterniflora and a contribution from the standing crop of S. patens of 140 tons. The major portions of this vegetation are located in three places: at Congress Street, at the sewage outfall, and at a cove to the northwest of Thompson's Point.

The topography to the north of the river's tidal area rises steeply to a height of about 47 feet. The major portion of this hill has developed as residential use and the vegetation present is of the hardwood-white pine community. There are 53 acres of this cover type, which represents 13% of the total hardwood-white pine community for the study area.

The major portion of open area vegetation in this area exists to the north of the Portland Terminal rail line, and is mixed with both hardwood-white pine and developed areas.

The most vegetatively diverse parcel of land north of the Fore River channel exists to the northwest of Thompson's Point where an extensive (2,400 feet long) portion of hardwood-white pine (37 acres) mingles with a tidal marsh (14 acres) cove to the rear of this industrial area. Here, again, the diversity of the vegetation would serve to satisfy the numerous requirements of a variety of wildlife.

The remaining portions of vegetation on the north side are intermixed with developed residential or industrial areas and are considered of minor value to wildlife.

The southerly side of the Fore River channel is primarily tidal flat with a single large portion of S. alterniflora (19 acres) extending out into the tidal flat below the airport (Figures 22 and 23). From this point east, a narrow band of S. alterniflora with small pockets of S. patens to the rear, extends along the southerly shore of the tidal area to Long Creek. Representing 34% of the S. alterniflora growth in the study area, this single largest stand could contribute as much as 94 tons of vegetative mass to the estuarine food web each year. The contribution from S. patens in this portion of the study area is much smaller, amounting to 20 tons from the standing crop. S. patens growth here represents only 3% of this grass species in the entire study area.

As the Fore River meets the upland on the southerly side of the main channel, there is a steep slope upwards toward the airport runways. This slope is covered with small pockets of hardwood-white pine along with some shrubs and grasses and does not provide significant acreage of wildlife habitat.

The area east of Westbrook Street on the southerly side of the Fore River is essentially developed as part of the Portland Jetport complex and the vegetation here is of little importance. East of Congress Street and west of Westbrook Street in the vicinity of the Stroudwater Historic District one finds an

extensive open area-shrubland-hardwood-white pine vegetative mix interspersed with large portions of developed land. The largest block of this mix is composed of 81 acres of open area growth interspersed with 34 acres of hardwood-white pine and 6 acres of shrubland. Surrounded by residential and industrial development, this essentially open field environment with interspersed wood and shrubland provides excellent habitat for small mammals, song and game birds.

The third section of the area is bounded by Westbrook Street on the north, Congress Street on the south and east, and I-95 on the west. The predominant natural feature in this portion of the study area is the Stroudwater River. The vegetative cover is extensive and diverse with hardwood-white pine (84 acres) in two large blocks, low shrubland (17 acres) bordering the river and adjacent stream drainage, shrubland (14 acres) intermixed with the two previous types and an extensive parcel of open area (99 acres). A stand of pure white pine (3 acres) occupies an area approximately 1,600 feet long by 75 feet wide in the central portion of the area. This band extends from the utility right-of-way north to the Stroudwater River. With the exception of a 400-foot strip abutting Westbrook Street and a 150-foot strip on Congress Street, the whole area is encompassed by land developed in either residential or commercial uses or the Maine Turnpike. These 217 acres represent 23% of the vegetative cover in the entire study area. The horizontal and vertical spatial distribution of this vegetation, as well as the species composition, provides for large areas of "edge" conditions. This condition is enhanced by the existence of a readily available source of good quality fresh water in the Stroudwater River. The vegetative stands, although intermixed, are individually large enough to support home range requirements for many species of wildlife.

4. Wildlife

Wildlife relationships in the study area are closely intertwined with both vegetation and water. Within the area it is logical to divide these relationships into two categories: aquatic-wetland and upland.

a. Aquatic-Wetland

This system supports many divergent forms of life. Detritus produced by bacterial action on the various marsh grasses, along with numerous species of algae and plankton, form the basic blocks of the food chain. This material is fed upon by numerous species of marine invertebrates which inhabit the Fore River. Of these many invertebrates, a few deserve special mention. Large numbers of holes for the clam worm (Nereis) were noted during a half-mile transect along the tidal flats north of the Fore River channel; however, square-foot samples at 50-foot intervals revealed an average count of only two individuals, which were generally small in size. At the same time large numbers of shore birds such as the least sandpiper (Erolia minutilla), killdeer (Charadrius vociferus), and semiplamated plover (Charadrius hiaticula) indicated that heavy feeding by these birds on the clam worms and nematode worms (Nemathelminthes) was taking place.

Observations also indicated that at one time large numbers of soft shelled clams (Mya arenaria) inhabited the Fore River tidal flats; however, sampling revealed only a few live specimens which were judged to be slow-growing individuals by the growth rings of the shells. It is not known why the clams have been so drastically reduced in number; however, past oil spills in Portland Harbor or slugs of toxic materials from the sewers may have been the cause.

Large quantities of dead, blue mussel shells were also evident, but viable beds were noted on the southerly side of the channel east and west of Long Creek and also at I-295. The larval forms of this bivalve provide food for numerous species of finfish, while the adults are a major food source for waterfowl species, such as the greater scaup (Aythya marila), bufflehead (Bucephala albeola), and golden eye (Clangula clangula) which are common in the Fore River during late fall and winter as long as the water remains open.

Another valuable invertebrate animal food for waterfowl, especially the abundant black duck (Anas rubripes), is the common mud snail (Nassarius obsoleta). Extremely abundant on the tidal flats, as well as in the marsh grasses, this organism is one of the major food sources for the black ducks and mallards (Anas platyrhynchos), some of which seem to inhabit the area year-round. This food source is especially vital during winter months and is taken readily until covered with ice and snow. Wherever the flats are open, ducks will find these snails and use them as a food source.

Haul seine results also indicated a normal food chain in the Fore River. Isopods (Isopoda) and Amphipods (Amphipoda) were captured in plentiful numbers, as were shrimp (Crangon spp.), and small baitfish, such as the common mummichog (Fundulus heteroclitus), striped mummichog (Fundulus majalis), three-spined stickleback (Gasterosteus aculeatus) and four-spined stickleback (Apeltes quadracus). These organisms all support larger species of finfish, such as the winter flounder (Pesudopleuronectes americanus), the anadromous alewife (Pomolobus pseudoharengus) and smelt (Osmerus mordax) which are reported to frequent the Fore River in relatively large numbers. Striped bass (Roccus saxitalis) was also reported to have frequented the river in the past; however, no catches or sightings have been reported recently. Sea run trout, probably brook trout (Salvilinus fontinalis), were reported by sportsmen in the area. These fish probably migrate to the area either from the Stroudwater River system or the headwaters of the Fore River.

The waterfowl using the estuary also will feed on the smaller finfish and crustaceans, but one of the most commonly sighted birds using this portion of the food chain is the great blue heron (Ardea herodias). These birds are plentiful throughout the estuary, as well as at Capisic Pond. They are reported to appear in the area as soon as the ice starts to break up and to remain until very late fall.

Other common fish-feeding birds sighted frequently in the study area were the belted kingfisher (Megaceryle alcyon) and the double-crested cormorant (Phalacrocorax auritus) which lends further evidence to the abundance of fish in the Fore River system.

Of particular note when discussing fish-feeding birds in the Fore River estuary is the sighting of an osprey (Pandion haliaetus). At the present time this species has an undetermined status with regard to the Federally published Endangered Species List which means that the species may be on the verge of possible extinction, but not enough information is available to make this determination. The existence of osprey in the study area was confirmed by local sportsmen, but sightings have not been made by Maine Audubon Society. There is no indication that osprey breed in the study area nor is there evidence of the presence of any endangered species.

The most commonly visible residents of the avian community are the shorebirds and waterfowl. Of this group one of the most significant birds is the black duck. The Fore River estuary is heavily used by this species, especially the marsh west of Congress Street. This area provides a wide variety of food sources, cover, and potential nesting sites in the upper westerly reaches for this species. Observations of the black duck on the site ranged from 50-200 birds using the estuary from September 1973 through January 1974. Areas of concentration differed with both tides and weather conditions. As the water level rose on the incoming tides, these birds used the marshes on either side of the Portland Terminal rail line and as many as 75 birds were noted on this portion of the marsh at one time. As the tides receded, the birds tended to string out along the main channel from just west of Congress Street easterly to Thompson's Point. Concentrations were located at the confluence of the Stroudwater and Fore Rivers, the 30-inch sewage outfall, and the cove to the rear of Thompson's Point. During these periods the birds were observed feeding heavily on the snails occupying the tidal flats. On the incoming tides they tended to concentrate on "puddling out" the widgeon grass and dwarfed spikerush located in the upper reaches of the marsh as well as feeding on finfish and crustaceans which were readily available during these periods. During winter periods, the marsh and tidal flats west of the 30-inch sewage outfall developed a heavy cover of ice and snow, and the waterfowl and shore birds tended to concentrate downstream from this outfall as this area contains the only significant open water in the study area during these times.

There was little evidence of mammalian species residing in the salt marshes; however, there were very limited signs of use by the muskrat (Ondatra zibethicus).

b. Upland

The upland wildlife species are quite diverse, as the vegetative conditions allow for the filling of numerous "niches" in the area.

The ruffed grouse (Bonasa umbellus) and ring-necked pheasant (Phasianus colchicus) were noted as gamebirds which inhabit a range of vegetative communities in the area, with the pheasant drawn to the more open edges near the Stroudwater River and the grouse using the more forested edges toward the west.

Songbirds were present throughout the area; however, visual observations were limited in extent. Warblers were noted along woodland margins and sparrows,

particularly the song sparrow (Melospiza melodia), were fairly abundant. In open weed field areas, the goldfinch (Spinus tristis) was common.

Predators such as the red-tailed hawk (Buteo borealis) and red fox (Vulpes fulva) were present, which indicates abundant small mammal populations that supply the major portion of the diet for these animals.

The presence of the omniverous raccoon (Procyon lotor) in the more forested portions of the area is indicative of an adequate supply of large hollow trees for preferred den locations. The woodchuck is also fairly common in the more brushy edges of the open areas where it finds the vegetation preferred in its diet.

The largest wildlife species noted for the site is the white-tailed deer (Odocoileus viginianus). Tracks of this species were noted along the Portland Terminal rail line. The study area does offer a wide variety of food for this species including adequate winter browse, and while the site is close to an urban area, it has a large enough undeveloped and diverse habitat to attract this animal.

II. RELATIONSHIP OF PROPOSED ACTION TO LAND-USE PLANS, POLICIES AND CONTROLS FOR THE AFFECTED AREA

The proposed action is in agreement with land use plans, policies and controls for the city of Portland. According to the Portland Land Development Plan final draft report published in June, 1973: "Extensive planning has been done on a proposed controlled access route which would run in an east-west direction along the southern portion of the City to ease the congested traffic movements to and from the central City for those who reside in communities to the west. The proposed Westbrook Arterial would link I-295 and Congress Street with a connector road in Westbrook."

Under its list of Transportation Policies (#4) the Portland Land Development Plan states:

> "Portland will soon be ringed by limited access highways. Although the Maine Turnpike is the only such highway existing in the City, I-295 is scheduled for completion in late 1974. The proposed Westbrook Arterial would add a vital east-west link to this network of outer-circumferential highways. Despite the existence or the proposed development of such highways, access to the City from only one of these routes (I-295) appears to be adequate to improve the movement of traffic within the City. At the present time, large volumes of through traffic utilize local streets such as Forest Avenue, Allen Avenue, Auburn Street, Washington Avenue, Stevens Avenue and Brighton Avenue to reach destinations within and outside the City. The addition of a circumferential highway system in peripheral areas of the City would lighten the load on such local streets by channeling through traffic onto controlled access highways."

The proposed action, along with proposed sewers, would help to create an atmosphere conducive to industrial, commercial and low density residential development in designated "Development Areas". The Land Development Plan has anticipated and encourages these potential growth opportunities which are associated with the proposed action.

Present and proposed zoning by-laws for the City also reflect the need and desirability of the proposed action. These present and proposed changes are outlined in the Land Development Plan.

The Portland Area Comprehensive Transportation Study (PACTS) which was published in 1965 and updated in 1970, also recognized the desirability and need for the proposed action and suggested a general alinement for the Westbrook Arterial.

The Maine Department of Transportation (MDOT) entered into agreements, in the fall of 1965, with the City of Westbrook and the City of Portland to construct the Westbrook Arterial. Since that time the land use plans, policies and controls for the affected area have reflected this agreement on the proposed action.

The proposed action does come into conflict with statements of policy at both the State and Federal levels with regard to the preservation of wetlands.

The United States Environmental Protection Agency's (U.S.E.P.A.) policy statement on Protection of the Nation's Wetlands states the following: "The purpose of this statement is to establish EPA policy to preserve the wetland ecosystems and to protect them from destruction through waste water or nonpoint source discharges and their treatment or control or the development and construction of waste water treatment facilities or by other physical, chemical, or biological means."

The policy statement continues: "Protection of wetland areas requires the proper placement and management of any construction activities and controls of nonpoint sources to prevent disturbing significantly the terrain and impairing the quality of the wetland area."

Further, the policy states: "In its decision processes, it shall be the agency's policy to give particular cognizance and consideration to any proposal that has the potential to damage wetlands, to recognize the irreplaceable value and man's dependence on them to maintain an environment acceptable to society, and to preserve and protect them from damaging misuses."

Although this U.S.E.P.A. policy statement does not provide for a veto power over proposed projects, it does indicate the Federal Government's concern for wetlands preservation.

At the State level, the Legislature passed, and the Governor approved, on June 28, 1973, an act extending the deadline for compliance with Mandatory Shoreland Zoning. The following appears in this Act:

> "To aid in the fulfillment of the state's role as trustee of its waters and to promote public health, safety and the general welfare, it is declared to be in the public interest that shoreland areas defined as land within 250 feet of the normal high water mark of any pond, river or salt water body be subjected to zoning and subdivision controls. The purposes of such controls shall be to further the maintenance of safe and healthful conditions; prevent and control water pollution; protect spawning grounds, fish, aquatic life, bird and other wildlife habitat; control building sites, placement of structures and land uses; and conserve shore cover, visual as well as actual points of access to inland and coastal waters and natural beauty."

On July 24, 1974, the Board of the Maine Department of Environmental Protection voted to place a moratorium on development along shoreline sections of 222 communities that had failed to comply with the requirements of the Shoreland Zoning Act by July 1, 1974. The city of Portland was included in the communities affected by the moratorium. The effect of this moratorium on the proposed action is unclear at the present time. However, in attempting to reconcile the conflicts between Portland land use policies and those of the Federal and State governments, involving the wetlands areas, the Maine Department of

Transportation has proposed alternates which minimize, as much as feasible, the damage to the wetlands involved.

In addition, the proposed action will be subject to review by the Maine Board of Environmental Protection in relation to the permit requirements of the Coastal Wetlands and Zoning Laws.

Further, the environmental impact statement review process, which includes reviews by the U.S. Environmental Protection Agency and the Maine Board of Environmental Protection with specific regard to the wetlands use, should provide the impetus for the reconciliation of the wetlands land use questions.

III. THE PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT: REGIONAL AND COMMUNITY

A. REGIONAL

Significant beneficial impacts of the proposed action to the region as a whole are realized with the construction of a major east-west arterial which will provide for safer and faster vehicular movement between Portland (and I-295) and Westbrook-Gorham and the more westerly areas of the state. Ease of access between downtown Portland and the Maine Turnpike will also be provided, generally for traffic to and from the northerly sections of the state. The arterial will provide for interchanges with existing roads, which will enhance access to major developments to the south such as the Maine Mall, Portland International Jetport and Union Mutual Life Insurance Company. A revitalization of the downtown Portland area, the region's leading trade center, is linked to the construction of the Westbrook Arterial, as is the development of industrial, commercial and residential acreage located adjacent to the Arterial. The Westbrook Arterial will also enhance traffic service in the region by providing relief to the Brighton Avenue corridor as well as reducing congestion on Westbrook Street between Stroudwater and Westbrook and on Congress Street between Libbytown and Stroudwater. Also, the visual aspects for the highway user will be enhanced as a result of exposure to the Fore River estuary.

However, an adverse, regional impact does occur in relation to Casco Bay. As a result of reducing acreage of productive wetlands in the Fore River, a portion of their contribution to Casco Bay's food web is eliminated, thereby reducing the potential carrying capacity (the maximum biomass that a system is capable of supporting continuously) of Casco Bay. According to the Maine Department of Inland Fisheries and Game there are approximately 916 acres of tidal wetlands in or adjacent to Casco Bay. A quantitative assessment of the contribution that these wetlands make to the food web of Casco Bay is not feasible at this time. However, it is known that tidal wetlands do play a major role in supporting the food web as well as providing spawning and nursery areas for wildlife.

B. COMMUNITY

In a cumulative fashion the Westbrook Arterial project has the potential to stimulate considerable economic growth for the City of Portland. Land values in the study area would increase, especially in areas that are presently less accessible. The potential to attract new industrial and commercial uses is high due to creation of prime locations in relation to the transportation network. This potential attraction is important due to the primary role that Portland plays as a major distribution center for northern New England. The location of new industrial and commercial facilities in Portland would create new employment opportunities, which would help to reduce some unemployment problems facing the City, as well as attracting new individuals to the labor force. The Arterial will stimulate the construction industry, not only through the building of the actual facility, but also by generating increased activity in the building trades as new industrial, commercial and residential development takes place.

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The demand for more high-quality, low-density housing in the city of Portland is considerable. An indication of this demand is demonstrated by the growth rate in Nason's Corner. On a city-wide basis the addition of new housing units in this category has contributed little to Portland's housing stock. Restrictions on waste disposal systems due to soil characteristics, in combination with street congestion, have been major reasons why development of the Stroudwater neighborhood's available land has been limited. If these problems are solved, this land will probably move into the housing market. The result may be that people seeking lower density units in the surrounding suburbs will consider remaining within the city limits, thereby slowing Portland's population decline. The increase in available housing stock should also help to supply the new demands for housing created by immigrants attracted by new job opportunities.

Although the growth associated with the Westbrook Arterial will create the demand for increased municipal services (fire, police, schools, recreation facilities) the tax revenue generated as a result of industrial, commercial, and high-quality, low-density housing should more than offset the increased expenses incurred by the City. It should also be considered that the efficiency and speed with which some of these municipal services (fire, police, ambulance service) can be delivered will be increased by the development of an east-west Arterial link.

The Westbrook Arterial should also have a beneficial impact on the downtown retail sales volume in Portland which has been faced with strong competition from shopping malls located outside the city limits. With the provision of safer, faster access to downtown Portland, the Arterial will help to stimulate downtown economic growth. This benefit, along with the improvement of local streets, the Maine Way Urban Renewal Program, and the provision of an additional 3,000 parking spaces will all combine to enhance downtown Portland as a viable competitor with outlying shopping areas.

In a more specific fashion, a major impact would be in the I-295 interchange area. At the present time this area is zoned industrial, commercial and residential. In the Portland Land Development Plan this area is designated as an area of transformation meaning that, due to various pressures, this section is predicted to undergo significant future change. A major cause of this change will be as a result of the I-295 interchanges with Congress Street and the Westbrook Arterial. The exact type of development which will eventually occur here is undertermined at the present time; however, the recent construction of a 150-unit Ramada Inn, a Bonanza Restaurant and gasoline station indicate highway-oriented commercial uses with good potential for industrial development, also. At this time, city officials have not proposed any zoning changes for this area, due to its unstable nature.

Further to the west of the I-295 interchanges there is an area designated by the Land Development Plan as a "Development Area". (Development Areas are parcels of large, contiguous, vacant land that, for the most part, are unsewered and contain portions of what the City refers to as retarded subdivisions.)

At the present time the land in question is zoned partially residential and partially industrial. There are residences in the area, but the industrial portion is vacant. A zoning change is advocated by the City which would result in the northerly portion changing from industrial to residential and an approximately equal portion of land to the south changing from residential to industrial. These changes would allow for continuity of these zones, should Line B be chosen. Since Lines A, B-1 and C pass through this area further to the north, thus isolating a larger portion of the residential zone, the pressure could mount to zone all of the land in this area south of the Arterial as industrial. Such a change seems logical to prevent isolation of a small portion of a residential zone between a major highway and an industrial zone.

It would seem that industrial uses would be attracted to this area if the Westbrook Arterial were to be built, as it would provide for major east-west access and a link-up with I-295 for north-south movements. Depending on the location selected, the Arterial could also provide valuable exposure to industries located close to it.

An interchange placed at Congress Street would also generate pressure to provide zoning that allows commercial and/or industrial development around it. Depending upon which alternate is chosen, this development could occur either in the vicinity of Boody Street or between Frost Street and the Fore River Bridge, or southerly near the Brooklawn Memorial Cemetery. The potential for development of this nature is reflected in the Portland Land Development Plan. This proposal allows a general commercial zone in the vacant northeast quadrangle of the interchange originally proposed for Line B at Congress Street.

Still further west in the study corridor, one can expect to see industrial and commercial development occur in the vicinity of the Portland Connector and Maine Turnpike. The Land Development Plan reflects this potential urbanization by recommending zoning changes from industrial, commercial and residential to business park, both east and west of the Portland Connector. The business park designation would allow any use permitted in the industrial zones as well as airports, heliports, arenas, auditoriums, auto rental agencies and general offices. It also provides for conditional uses permitting radio and television towers, private, commercial/recreational facilities and public utility services. At the present time these zoning changes are proposed for the northerly side of the Westbrook Arterial between the interchange and Brighton Avenue. At present the land to the south of this partial interchange is zoned residential. However, the location of this land in relation to the Maine Turnpike, Portland Connector, and the proposed Westbrook Arterial makes it a prime location for industrial/commercial use, and as the need for this type of land grows, pressure to zone this area for these uses will mount considerably. The development of business uses along the Portland Connector indicates the desirability of this site for industrial/commercial uses. This potential is enhanced by the fact that the Bureau of Highways is also proposing to take the right-of-way for a full interchange at the Portland Connector. In the future this interchange will be developed as traffic needs increase and could provide access to the land south of the connector.

To the south of this area, the location of Union Mutual Life Insurance Company in a business zone, as well as the designation of an extensive industrial zone across Congress Street and west of the Maine Turnpike, indicates that the City of Portland recognizes the value of land abutting a major highway for these land uses. A zoning change is recommended for these areas from industrial and business to business park in the Portland Land Development Plan. An extension of this business park zone to the north and east near Union Mutual Life Insurance Company could be expected if Line C is constructed for the Westbrook Arterial. A zoning change for the airport business zone at the Portland International Jetport is also recommended in the Land Development Plan, which would result in the area being designated as a business park zone. A southerly location for the Westbrook Arterial can be expected to enhance further development of this zone as well.

Construction of the Westbrook Arterial would result in further urbanization in the form of residential growth. The Portland Land Development Plan has indicated that the residential growth will be of a low density nature, and it will be located primarily from Congress Street west to the Maine Turnpike in the Development Areas. Zoning changes have been suggested by the City to create this low density residential land use. These changes are mostly involved with changing higher residential land uses to low density use. The proposed Westbrook Arterial will enhance the development of these primarily vacant areas by provision of future access at the Portland Connector. The Arterial will also tend to relieve congested road conditions in Stroudwater on both Congress Street and Westbrook Street by facilitating through traffic movements on a major highway, which would permit both Congress Street and Westbrook Street to carry a larger proportion of local traffic with less crowding. The Congress Street interchange would also provide for easy access to the Arterial and from there to downtown Westbrook or Portland, as well as to the Maine Turnpike and I-295, thereby allowing residents ease of travel to all major areas of the region. This area also represents one of the larger and most desirable areas in the City potentially available for low density residential development.

A critical factor in the development associated with the Westbrook Arterial is the provision of sewage facilities to Development Areas within the study area. The City sewage plans indicate the construction of a Westbrook interceptor and a Stroudwater interceptor, both of which will provide service to the areas west of Congress Street. The Land Development Plan also recommends that the Stroudwater neighborhood and the Jetport receive high priority for major sewage improvements. The implementation of these major sewage facility improvements will result in this area being urbanized with or without the Westbrook Arterial, as it has been indicated that the prime reason development has been very slow in this vicinity is the poor soil condition, which is not readily adaptable to on-site sewage disposal. Sewer lines will eliminate this obstacle, and development will occur as a result.

The proposed Westbrook Arterial will provide a further stimulus to development in this area. It will help to reduce present congestion levels and absorb new traffic generated as a result of the development taking place in the newly sewered areas.

The impact that the Westbrook Arterial project would have on mass transit-dependent, non-drivers is positive. Bus service is the only significant form of mass transit in the greater Portland area. The action could stimulate provision of more and better bus service between downtown Portland and the Westbrook and Gorham areas. It is recognized that while population in Portland has declined, due to outmigration to the suburbs, many of these suburbanites still work in the city. If the need arose bus service could be improved by the addition of express routes via the Arterial between Portland and Westbrook, and locations further west. The improved bus service, by increasing patronage, could also result in somewhat less automobile traffic coming into Portland from outside the city limits, thereby increasing efficiency of local circulation and parking, and reducing potential air pollutant loads.

The significant adverse impacts that can be expected on the Fore River wetlands are the elimination of portions of the productive food web, reduction in carrying capacity and a reduction in scenic value. This long-term impact could be considered more significant if erosion control measures are not taken to prevent smothering of adjacent productive grasses in the wetland areas. The disturbance of soil in the study area caused by highway construction will result in a temporary increase of erosion, sediment load and turbidity in local streams. The introduction of pavement, graded slopes, and channelized drainage will increase rainfall runoff and stream flows, which could result in changes in stream erosion, turbidity and sedimentation. The proposed action, lying within the drainage basin of the Fore River, will have short-term adverse impacts to water quality in the estuary during the construction period.

As stated earlier, the critical factor in future development in the study area is the provision of sewers. Although the Arterial will enhance land development potential through improved accessibility, the increased accessibility per se is of little value without concurrent provision of sewers. Thus the impact of the Arterial on urbanization would be only to accelerate the pace of development once sewers were provided. This urbanization would take the form of increases in commercial, industrial and residential land use. The resulting construction will temporarily increase erosion and the sediment pollution of local waters. Large areas of pavement such as shopping centers and service stations are commonly attracted to arterial highways. This type of development can have a significant impact on infiltration and groundwater levels. Runoff from large acreages is often collected and diverted to previously small drainages. The discharge of high volume, turbid, fresh water into these areas could also have significant impact on water quality. However, large scale developments must undergo an environmental review process by the Department of Environmental Protection, and small-scale development projects would still be subject to review by the Portland Planning Board. These review processes would tend to insure compatibility with the zoning bylaws and Land Development Plan of the City of Portland as well as with state and regional plans and goals.

As a result of increased development in the Stroudwater area, the city of Portland would lose one of the most significant, large areas of "natural" open space remaining within the city limits. In the Land Development Plan it is

noted that the Stroudwater neighborhood, at the present time, has no recreation areas that are owned and maintained by the City. It is also recognized that there is a great deal of open space that is used by the residents, but it is privately owned and potentially available for future development. With the advent of improved sewage systems (and to a lesser extent, the Arterial), it is projected that much of this land will be developed and its present recreational potential lost to the city.

The significance of this open space within the city is difficult to quantify given the fact that, at the present time, there are large areas of a similar nature outside of, but within easy reach of Portland. However, as suburbanization spreads, and population grows, this type of land will become more scarce. Although the area is zoned as low density residential for future development, it is also reasonable to assume that the rural character will be diminished or lost as a result of increased numbers of houses, sewer lines, a highway and industrial and commercial facilities. However, the land values will increase because of the shortage of low density housing in the city, so the economic gain as a result of this development will persist.

IV. BENEFICIAL AND ADVERSE EFFECTS OF ALTERNATIVES

The previous discussion of alternatives in Section I.A.4. outlined the several alternatives which were objectively evaluated as potential solutions to the transportation demand in the Brighton Avenue corridor. Several of the alternatives showed significant deficiencies towards fulfilling the objectives of the proposed action, and have been discarded from further detailed evaluation. The remaining highway location alternates, Lines A, B, B-1 and C are described below in terms of their specific social, economic and environmental effects on the study area. Although each of the alternates has both positive and negative aspects, in some instances measures can be taken to minimize the potential adverse effects on the environment.

A. SOCIOECONOMIC

1. Impacts to Highway User

The development adjacent to Brighton Avenue and the gradual increase in through traffic in the highway corridor have produced congestion and safety problems. From 1970 to 1972, the accident rates on Brighton Avenue between Capisic and Riverside streets and between Stevens and Deering avenues have exceeded the statewide average. Without the Arterial, the 1994 traffic demand in the Brighton Avenue corridor will exceed the maximum capacity of the two principal roadways--Brighton Avenue and Westbrook Street. With the Arterial attracting substantial traffic because of its superior traffic service, the residual traffic on Brighton Avenue and Westbrook Street will be less than the maximum level of service C volumes, thus allowing for a freer flow of traffic. The lower traffic volumes on Brighton Avenue will also have a favorable impact on accident rates for this roadway.

Construction of the Arterial will reduce travel time for through traffic primarily through bypass of stop-and-go driving conditions, and the high design standards will permit higher average operating speeds than presently attainable on either Brighton Avenue or Westbrook Street. As compared to the No-Build alternative, the aggregate time savings and reduced operating costs will be of considerable economic benefit for the three northerly (A, B, B-1) alinements in particular. Line C, due to greater travel distance and lower traffic volumes, results in a significantly lesser amount in annual savings.

The Stroudwater Arterial Study conducted by the E.C. Jordan Co., Inc., for the City of Portland in 1970, established the desirability for better access to the Portland International Jetport; the recommendations of the study included the development of an access route similar to that of Line C, which would tend to relieve traffic volumes on Congress Street and on that portion of Westbrook Street that passes through the Stroudwater Historic District. These accomplishments are judged to be beneficial impacts of Line C.

A 1965 California study indicated that the accident cost per mile driven (i.e., the direct accident cost, excluding the indirect cost of fatalities) for urban freeways was 0.21 cent as compared to the non-freeway cost of 0.69

cent. While these costs are not necessarily valid now due to inflation, it seems reasonable to assume that the relative cost comparison of freeway and non-freeway driving would still be accurate. Using the relative cost rather than absolute cost, a comparision of annual accident cost savings was made for each of the alternates and the Do-Nothing alternative for 1994 traffic based on annual miles of travel on the Arterial (freeway) and on the major existing streets (non-freeway) which would be affected by the Arterial. The results do not favor any particular alternate, but indicate that each of the lines would reduce annual accident costs by approximately 24% compared to the Do-Nothing alternative.

In addition to the more readily identifiable benefits of reduced transportation costs and improved safety, there are psychological benefits to be derived by the highway user. Reduction (or even elimination) of such factors as frustration and tension, and improved driver orientation and directness of travel all contribute to enhancing the quality of travel.

2. Displacements of Families, Businesses and Farms

At this preliminary stage, an effort has also been made to identify particular impacts due to the potential physical displacement of residential, business, institutional and agricultural properties, as well as the general current availability of replacement facilities. Wherever possible, socioeconomic information has been aggregated for individual households, and agricultural and institutional operations have been assessed. The following data, it should be noted, were gathered from secondary sources (i.e., potential displacees were not contacted directly) and are limited to that extent; moreover, replacement housing and commercial relocation property availability was based on surveys conducted early in 1974 from a variety of sources. Rather than implying that these replacement sites are currently, or will remain available, the aim at the conceptual stage is to evaluate the general atmosphere (e.g., real estate turnover) for relocation of homes and businesses at comparable sites within the same neighborhood or municipality of displacement. Based on this evaluation, situations demanding more in-depth information or illustrating particularly severe anticipated impacts can be identified.

The following table indicates the number of units in each displacement category that would be involved for each alternate.

Table 20

DISPLACEMENT OF FAMILIES, BUSINESSES AND FARMS

	Families	Businesses	Farms	Other
Line A	34	4	--	--
Line B	3	2	--	--
Line B-1	7	2	--	--
Line C	14	--	1	1

a. Line A

The six displacement areas affected by this alternate are in the Rosemont neighborhood (Figure 12, page 41) and involve the following locations: Riverview Street, Bancroft Court, Frost Street, Congress Street, Westland Avenue and Powsland Street. A total of twenty-seven single-family and four multi-family dwellings housing 34 families or individual residents would be acquired under this plan. There would be 4 business displacements: a gasoline station, real estate agency, travel agency and an insurance agency.

Residential

The Riverview Street displacement area is a quiet, residential neighborhood of small, older homes on a dead-end street. There is an impression of remoteness from the city although facilities and routes are readily accessible. The potential displacements are 6 older, bungalow style dwellings containing from four to six rooms, with both families and retirees represented. Eleven replacement sites, deemed somewhat comparable in terms of size, price and neighborhood atmosphere, were detected via real estate sampling; significantly, only two of these fell within the Rosemont neighborhood boundary. The remainder are distributed over five other Portland neighborhoods. No replacement site is farther than the displacement area from a bus route, and only one replacement site is farther from an elementary school. Distance to other facilities varies; nevertheless, no site is farther than three miles from any facility (church, school, stores, public transit) or more than 1.4 miles farther than displacements now are from corresponding facilities.

The Bancroft Court displacement area is very near Riverview Street and is similar in that it is also a dead-end street; however, it is generally an area of more recent, expensive homes. Of the three potential displacements, one structure is brand new and unoccupied while the others are about 15 years old and contain five and six rooms. Of 10 reasonable replacement sites two were reported to lie within Rosemont. As with Riverview Street, the remaining sites were located in adjacent and nearby neighborhoods over the entire city. Replacement site distances from facilities vary but the majority were within the same distance as the displacement area.

Frost Street, in the vicinity of the 5 displacements, is residential in character with well-maintained and relatively recent homes, for the most part. Only one older home of lesser value was evident. Unlike the areas outlined above, this street is subject to heavier through traffic as it functions as a short-cut between Stevens Avenue and the Stroudwater end of Congress Street. The one older displaced dwelling has eight rooms, while the four newer units displaced have between four and six rooms. Both retirees and working families are represented. Of thirteen potential comparable replacement sites, only one Rosemont neighborhood site is noted; and while the displacement area is within 1.8 miles of all facilities, comparable sites are as far as 3.5 miles from certain facilities (over half are farther away than the displacement area).

Congress Street's 1300-1400 blocks still contain some older single and multi-family dwellings, but this arterial street has been in transition to commercial use for some time. The potentially displaced dwellings are opposite, or very nearly so, to the Westgate Shopping Center; and the street carries high vehicular volumes between the city and outlying areas to the southwest. The displacement area contains 4 single-family houses (one not inventoried in detail) and three multi-family dwellings. The former include an 8-room house approximately 100 years old, a 5-room house approximately 80 years old, and a 6-room house approximately 45 years old; the multi-family structures contain two, three and four units, range from 40 to 75 years in age, are in fair to good condition. The potential displacees include 10 families or individuals, six of whom are retired. The eleven replacement sites inventoried indicate that all single-family comparables are within 0.4 mile of bus routes and 1.0 mile of a shopping center, while distances to churches, schools and other facilities range up to a maximum of three miles from the multi-family buildings. A total of four sites (3 single-family; 1 two-family) were located within Rosemont.

While several blocks apart, the Westland Avenue and Powsland Street displacement areas are very similar neighborhoods. Both are dead-end streets off the southerly side of Congress Street and contain mostly single-family homes having four to seven rooms and ranging from 20 to 60 years in age. The exceptions consist of a 100+ year old, two-family home on Westland Avenue and a four-year-old cape on Powsland Street. One large barn structure, presumably utilized for storage would also be taken. Although generally appearing well cared for, these homes are in the lower range of value, primarily due to an unattractive adjacent area containing rail and power transmission lines. Westland Avenue's displacement area contains 5 single-family dwellings and one 2-family home. Both retirees and working families and/or individuals are represented. A comparable replacement site inventory indicated that eight single-family units and three multi-family structures were available. Two sites were identified within Rosemont's neighborhood boundaries. Distances to facilities from the displacement area range from 0.1 to 1.8 miles. Distance of single-family replacement sites to corresponding facilities is generally as far or farther, except for elementary schools and churches. Shopping centers are up to 2.2 miles distant compared to the present 0.2 mile. The multi-family sites, similarly, are farther from shopping and churches than the displacement area, but generally closer to other facilities. Potentially displaced structures on Powsland Street include one 25-year-old ranch, one 4-year-old cape and two larger older homes. Both retirees and working families and/or individuals are represented. Similar replacement sites include ten homes available for sale although none were within Rosemont. With the exception of bus routes and elementary schools, replacement sites were found to be generally farther from corresponding facilities (greater than 1.5 miles) than the displacement area.

Business

Businesses which would be subjected to displacement by Line A include a gasoline station, travel agency, real estate agency and insurance agency. All are located on Congress Street.

The "Hercules" gas station (also displays Gulf sign) consists of two double pumps and a small office. No repair facilities are available on the premises. Replacement site potential was identified in two areas only, Woodford's Corner and Route 1 in Falmouth.

The remainder of the commercial displacements are located in a group of well maintained structures (converted residences) near the Stevens Avenue/Congress Street intersection and immediately across from the Westgate Shopping Center. The travel agency employs two persons, occupies approximately 800 square feet and is primarily engaged in arranging group tours. Much of their business is phone and mail oriented and less reliant on "off the street" customers. The real estate operation occupies approximately 1,700 square feet and serves as a base for four or five employees out of a total of seventeen (the remainder are mainly home-based salesmen and brokers). Lastly, the insurance firm is in the process of expanding and will eventually employ six to ten people with a space requirement of 1,400 square feet.

The real estate agency and insurance firm would both require an estimated ten parking spaces, are generally satisfied with their present location, and would not want to relocate any further from downtown. Location and customer parking are not critical factors with respect to the travel agency. Replacement office space was noted on sample dates on Congress and Exchange streets, in downtown Portland and on Forest Avenue in the same general displacement vicinity. Space and location at the sites above would seem to be adequate for the travel agency; however, space limitations would appear to exclude downtown as a reasonable site for the insurance agency. The real estate operation presents a unique situation as it owns the premises and no comparable buildings for sale appeared to be available in the nearby area. Mindful of an expressed desire to remain in the area for competitive reasons, office space was noted to be available for lease in the Westgate Shopping Center across the street, and might accommodate their needs.

b. Line B

The three displacement areas on Line B fall within the confines of the Rosemont neighborhood and involve one residential structure each on Congress Street, Osgood Street, and Powsland Street. Commercial displacement amounts to a portion of an equipment/materials storage area and a storage building on the banks of the Fore River and a gas station at the corner of Frost and Congress Streets. .

Residential

The one dwelling potentially displaced on heavily traveled Congress Street is located between the Congress/Frost Street intersection and the Fore River. The immediate vicinity is partially rural in character, influenced heavily by fields and woods behind the structure towards the river; however, nearby commercial uses in the form of the Portland Lithograph Company and a small service station on Congress Street point up the land use transition taking place in the area. The owner/occupant in this dwelling is retired. Four

potential replacement sites, two of which are in Rosemont, were identified via sampling. Distances to facilities from comparable sites are less than or equal to the present maximum of 1.8 miles for the displaced house.

Osgood Street, the location of another single Line B residential displacement is also situated between Congress Street and the Fore River and connotes a semi-rural atmosphere. Structurally speaking, the homes in this area are old and of lower value and quality. The streets have not been accepted by the City of Portland and are unpaved. The household head is employed. Of four replacement sites inventoried only one was located within Rosemont's boundaries. These sites were located in generally newer neighborhoods, ranging from more heavily traveled Brighton Avenue, to an older residential block adjacent to a cemetery. Distances to bus and elementary school facilities were significantly less than the present 2.1 mile maximum from the displacement area, while other facility distances varied up to that figure.

The Powsland Street displacement occurs at the deadend, and is minimally screened from adjacent railroad tracks and a power line. The one household head and his wife are currently employed. All three replacement sites deemed comparable to this dwelling unit (only one falls in Rosemont) are in older residential areas and not directly on main arteries. All appropriate sites are within the same 1.5 mile distance from most facilities as is the current case for the displacement area.

Business

The proposed Line B would displace a 1,400 square foot wooden storage building (in poor condition) and a portion of an open storage area currently utilized by a general contracting firm. The firm uses a portion of the residential lot of the firm's president for storage of equipment and materials. There is sufficient remaining land to accommodate the displaced storage facilities, but it is steeply sloping and its utilization is of questionable practicality without grading. The gasoline station is the same "Hercules" station displaced by Line "A" and has been discussed in the material pertaining to that line.

c. Line B-1

Residential displacements for Line B-1 occur in the Rosemont neighborhood on Congress, Caribou and Powsland streets and in the Stroudwater neighborhood on Stroudwater Road. A total of 7 residential structures are involved while 2 commercial properties (a service station and two storage buildings) would be displaced.

Residential

The Stroudwater Road displacement area is located at the end of a dead-end street within one of Portland's most exclusive residential areas. Many dwellings here are architecturally unique in style, and grounds are well maintained and attractive; furthermore, a wooded area screens this vicinity from the railroad and power lines which follow the upper reaches of the Fore River.

The two particular structures impacted have household heads employed professionally. Due to the isolation of this section, facilities are further away than for any other displacement area. Comparable sites were virtually nonexistent for the more expensive of the two homes above, however, a few dwellings available for sale do compare to the less expensive unit. One site, in fact, is in the same neighborhood on Stroudwater Road. Another site on nearby Westbrook Street compares in size and quality but is subject to heavier traffic. All in all, five sites are considered somewhat comparable with all of the sites inventoried closer to facilities than is now the case for the two displaced households.

The remainder of the displacements involve one household on Congress Street, two on Caribou Street and two on Powsland. The Congress Street residence has been covered in the material pertaining to Line B. Caribou Street, a short, dead-end and unpaved street, is located in Rosemont between Hobart Street and the Fore River in a semi-rural area. It is quite heavily wooded and is well insulated from traffic noise. Replacement site evaluation for Caribou Street is covered under Line C. The Powsland Street area previously described under Line A, is the site of 2 single-family residential displacements. A comparable replacement site inventory noted 6 homes as being available for sale. Compared to a current distance of approximately 1.5 miles from community facilities, replacement sites are located at both lesser and greater distances, none of which are farther than 2.5 miles.

Business

Businesses displaced by this line are a gasoline station and a contractor's storage yard with two buildings.

The gasoline station is the same "Hercules" station displaced by Line "A" and has been discussed in the material pertaining to that line.

Line B-1 would impact the contractor's storage yard to a greater extent than previously described for Line B. The firm uses a portion of the residential lot of the firm's president for storage of equipment and materials. Located on the property is a metal-covered industrial type building of about 2,100 square feet in good condition. Also used is a wooden storage building of about 1,400 square feet in poor condition. Both buildings and a portion of the open storage area are to be acquired. There is sufficient remaining land to accommodate the displaced storage facilities, but it is all steeply sloping and its utilization is of questionable practicality without grading. Two suitable buildings with adequate land are available in Westbrook and Scarborough, but the asking prices are far in excess of the estimated value of the subject property. Further, these locations are not suitable in that the owner would not have the advantage he now enjoys of being able to watch over the storage yard from his residence.

d. Line C

Five displacement areas have been identified on this line: two separate areas on Westbrook Street and one on Congress Street are in the Stroudwater neighborhood; the Caribou Street and Powsland Street areas are in the Rosemont neighborhood. A total of 14 families or individuals would be displaced by this alternate and institutional takings involve two buildings belonging to Brooklawn Memorial Park Cemetery. Finally, a significant portion of a small farm operation would be taken under this proposal.

Residential

The one dwelling displaced in the 1400 block area of Westbrook Street is an older structure in a section which is changing from semi-rural to suburban in nature. Just to the east is the Stroudwater Historic District, characterized by many stately, colonial style homes, although newer homes of varying quality occupy the vicinity between the district and displacement area. The owner-occupant household head was reported to be employed. Four comparable replacement sites inventoried were, for the most part, closer to facilities (other than employment) than the displacement area (range up to 2.5 miles).

Displacement of 5 residences would occur in the 1900-2000 area of Congress Street, where the atmosphere is semi-rural in nature and interspersed with a mixture of small, new houses and older, farm-related dwellings. Neighborhood vicinity land use includes a small farm, Elks Club, and cemetery. Congress Street carries heavy traffic at this point to the airport, Maine Mall, Union Mutual Life Insurance headquarters and an industrially zoned area. Ten comparable replacement sites were spread out over city neighborhoods other than Stroudwater; moreover, comparables in terms of atmosphere appeared non-existent. Current distance from facilities was estimated at between 0.7 and 2.8 miles, and replacement sites varied in the same order.

On Westbrook Street, but on the eastern side of the Stroudwater Historic District, is a displacement area involving two 2-family structures (housing 3 families) and one single-family structure. These households consist of one retired couple and a younger working couple. Proximity to the airport and exposure to noise from the north-south runway is one predominant feature of this area. Replacement site analysis indicated three comparable single-family units and three two-family units were available in residential areas, all of which were located in Portland neighborhoods other than Stroudwater. Relative to the current distance from facilities (up to 2.4 miles) replacements are closer, for the most part.

Caribou Street, described previously in discussions about Line B-1 displacements in the Rosemont neighborhood, would be subject to two single-family displacements. One household head was reported to be employed and resides here with his wife; the other also appears to be currently employed. Three comparable replacement sites are located in relatively newer residential sections (two within Rosemont), and are generally closer to all facilities (particularly bus routes and schools) than the area's present 2.1 mile range.

There would be 2 single-family homes displaced in the Powsland Street area (previously described under Line A). One head of household is retired; the other household displaced is a younger couple, both of whom work.

Cemetery

Two buildings belonging to the Brooklawn Memorial Park Cemetery are displaced by this line. These are adjacent to the grave site area and consist of a large, old two-story house utilized for offices and a small barn used for storage of equipment. The use of replacement buildings at another location would not be satisfactory from the standpoint of efficient operation, since the offices and equipment must necessarily be convenient to cemetery grounds. There appears to be adequate remaining land, not prepared for grave sites, to which buildings could be moved or on which new structures could be erected.

Agricultural

Under Line C a farm (approximately 18.8 acres) on the east side of Congress Street immediately north of Brooklawn Memorial Park would be severely impacted by takings. Rectangular in shape, the property includes a farmhouse-type dwelling with attached barns, and two small sheds. There is a small grove of apple trees, several large areas are utilized for vegetable gardens and several cattle are also kept. A portion of the produce is likely to be trucked to market from this operation.

The taking area, approximately 9.7 acres, curves across the property from the westerly corner to the easterly corner, dividing the property into two sections of approximately 3.4 and 5.7 acres. The remaining smaller parcel is at the northerly corner, abutting Congress Street, and contains the dwelling. The larger piece at the southerly corner is an area of grassland and scrub now apparently used as pasturage.

The taking of over half of the tillable area of this small farm, and the division of the remainder, virtually destroys it as a viable economic unit. The farmer has been reported to be retired, and a percentage estimate of the farm's contribution to his income was not available.

No suitable land is available in or near Portland at prices anywhere near the estimated value of this farmland.

e. Rental Units Displacement/Relocation

Although not addressed specifically under the separate alternate analyses above, tenant families would be displaced on Lines A (at least 10) and C (at least 2). At least five elderly tenant households would be included among those on Line A. Monthly rental estimates for each of these potentially displaced units were put at between $75.00 and $150.00; moreover, 1970 census statistics indicate that the median monthly rents in the neighborhoods in

which they occur, Rosemont and Stroudwater, were $88.00 and $77.00, respectively. Regarding replacement units, a four-day Portland Herald Press Survey study, conducted between March 3 and 6, 1974, indicated at least 112 unfurnished and 35 furnished apartments for rent over the period. Outside of Portland the availability total was 39 and 15, respectively. Rental ranges, likewise, varied widely over Portland from under $100 to just over $200 per month. Approximately 60% of the unfurnished apartments were three and four room units at rents between $116 and $175 per month. No analysis was conducted detailing neighborhoods or the distances of comparably priced units from community facilities.

f. Displacements From Other Federal/State Projects

Other projects presenting instances of residential and commercial displacements and competing relocation would appear to originate primarily from the programs of the Portland Renewal Authority. A fairly firm expectation of approximately seven residential displacements have been reported for 1975. For 1976 and 1977, a range has been estimated from a low of five to a high of thirty; moreover, there would be a possibility of up to ten business displacements each year.

Previous relocation experience involving residential and commercial displacements in Westbrook in connection with the Portland-Westbrook Arterial may be documented. Initiation of negotiations for the first parcel took place on March 15, 1971; the last vacating date was November 29, 1972. Eighteen owner-occupants of dwellings were displaced; of these, seven bought existing houses, seven bought new units, two purchased mobile homes and two moved into elderly housing. Three tenants were displaced; one purchased a mobile home and two rented other apartments. The two businesses displaced successfully relocated and continued in operation.

g. Nearby Vacant Land Analysis

Generally speaking, all alternates avoid densely built-up areas and, theoretically, there is adequate open space in the nearby vicinities to accommodate potentially displaced dwellings or new structures. A few of the more obvious constraints involved in site analysis for structure moving within the same neighborhood or municipality of displacement include geological, zoning, sewerage, ownership and availability considerations; however, these specifics have not been analyzed in detail at the conceptual stage.

A more selective survey (August, 1974) of available parcels for sale with residential development potential in Portland identified seven locations distributed over three neighborhoods (Table 21). Only two of these sites are located in a neighborhood where potential displacement would take place--Stroudwater. All are currently zoned for residential use, and a minimum total of 119 potential residential sites were evident.

Table 21

VACANT LAND PARCELS FOR SALE

Street Location	Neighborhood	No. of Lots	Lot Size	Price
Garrison/Congress	Stroudwater	Approx. 65	10,000 sq. ft.	$150,000 Total
Pennell Avenue	N. Deering	20	45' x 100'	$ 33,500 Total
Allen Avenue	N. Deering	1	122,000 sq. ft.	$ 32,800
Westbrook Street	Stroudwater	1	---	$ 10,500
Carter Street	N. Deering	2	---	$ 7,000 each
Kensington Street	---	1	11,000 sq. ft.	$ 2,900
Verrill Street	Riverton	29	30' x 100'	$ 4,500 Total

h. Comparative Impact Overview

In terms of absolute residential displacement figures, Line A would have the greatest impact, necessitating the relocation of at least 34 household heads or individuals (i.e., excluding spouses, relatives and children). This alternate would also impact 4 commercial enterprises. Line B would have the least impact, displacing only 3 residential households, a portion of a storage area utilized by a construction firm, and a service station. Line B-1 would impact 7 residential household heads, as well as a service station and the construction firm. Lastly, Line C would impact 14 households, 2 cemetery buildings, and a small farm which would lose a significant portion of its tillable acreage.

Besides comparative residential and commercial displacement totals as indicators of impacts, availability of relocation resources relative to alternate line displacement merits an evaluation. Except for a home on Stroudwater Road displaced by Line B-1, an adequate number of comparable residential replacement sites were determined to exist within Portland proper, although adequate sites within the same neighborhood of displacement were not. A total of 33 single-family and 5 multi-family structures, derived from a total sample (Spring, 1974) of 61 single-family and 8 multi-family units, were selectively applied to alternate lines as being comparable.

An additional socioeconomic impact, varying from alternate to alternate, involves the displacement of both elderly homeowners and tenants. On Line A, it has been noted, at least 10 of the 34 household head displacements are listed as being elderly. Except for one such tenant who is employed, the remaining 5 owner and 4 tenant household heads are retired. Lines B, B-1 and C would displace one, two and three retired owner-occupant household heads, respectively.

For elderly households, often subject to acute disposable income constraints, adequate replacement housing may very well have to draw from the public as well as the private sector. Regarding the former, the elderly public housing in Portland is in extremely short supply. As of early May, 1974, the several facilities of the Portland Housing Authority (total of 520 units) were 100% occupied and there was a waiting list of approximately 650 persons. Individuals displaced by a public project such as this would be given admission priority; however, the displacees might not be accommodated immediately, as the elderly turnover rate varies up to three or four per month. Another elderly housing resource, the Catholic Diocese of Portland, sponsors a 200-unit facility with rents subsidized under the Federal Housing Administration's Section 236 Program. No vacancies (May, 1974) and a very low turnover rate were reported.

The majority of commercial displacements, variable by line but greatest under alternate A, should be absorbed adequately within Portland. However, the "Hercules" gas station (Lines A and B-1), and the construction firm (B-1 and B) could have difficulty finding replacement sites compatibly zoned in the immediate displacement area, and perhaps within the city limits.

Agricultural and institutional property would be displaced by Line C only. The small farming operation is listed under the ownership of a retired individual, whose percentage of total income derived from agricultural activity has not been determined. An estimated 9.7 of the farm's 18.8 acres would be taken (consisting of over half of the tillable land) and the remainder would be severed into two pieces.

The severity of this displacement impact lies in the absence of farm properties within Portland at comparable price. A nearby and available 15-acre land parcel zoned Residential-2 at the Garrison Street/Congress Street interchange is presumably ready for development. Compounding the general exorbitant price situation, however, is the fact that reasonable proximity and access to agricultural land for farm equipment renders many vacant land replacement schemes inoperable.

Due to the likelihood of non-gravesite vacant land, the taking of two buildings on the grounds of Brooklawn Memorial Park Cemetery does not appear to propose a significant impact, although cemetery development plans may have to be altered because of it.

3. Tax Base and Property Values

Construction of the Arterial will have a direct impact on property tax revenues accruing to the City of Portland. The acquisition of residential and commercial properties varies significantly among the four alternates, with a corresponding degree of impact on the local tax base. Table 22 summarizes the assessed valuation of properties to be acquired, and the resultant tax loss for each alternate.

Table 22

ESTIMATED TAX LOSS BY ALTERNATE*

Alternate	Assessed Value of Acquisitions		Tax Loss
Line A			
Residential	$347,216		$19,000
Commercial	$ 63,162		$ 3,465
		Total	$22,465
Line B			
Residential	$ 34,656		$ 1,900
Commercial	$ 48,977		$ 2,685
		Total	$ 4,585
Line B-1			
Residential	$106,052		$ 5,820
Commercial	$ 56,006		$ 3,070
		Total	$ 8,890
Line C			
Residential	$120,861		$ 6,625
Commercial	$120,428		$ 6,600
		Total	$13,225

* The estimated tax loss is based on 1973 assessments and tax rate of $54.85 per $1,000 valuation, per the City of Portland Assessor's Office.

Based on assessed value of the displaced residential and commercial property to be taken for each of the alternates, total potential tax losses to Portland are greatest for Line A ($22,465), followed by C ($13,225), B-1 ($8,890) and B ($4,585). Except for Line B, residential losses exceed those in the commercial category. Compared to the City of Portland's total assessed valuation of nearly $295 million in 1973, the acquisition of property for the Arterial is not a significant loss.

The acquisition costs can be viewed as direct losses to the tax base of the City of Portland; it is also possible that residential land uses that abut or are quite close to the highway will experience a depreciation of land value. On the other hand, it is reasonable to assume that land values adjacent to major interchange locations will rise due to the increased desirability of these locations for commercial and for industrial development.

For Line A the existing commercial zone next to the proposed interchange on Congress Street would expand as a result of increased traffic which would be drawn toward this area. This increased traffic is a result of the dead-ending of Frost Street and people coming south on Stevens Avenue to enter the Arterial. At the present time most of this area is zoned for residential use with only the Westgate Shopping Plaza area being designated for commercial use.

For Lines B and B-1 the northeast quadrant of the Congress Street interchange is presently zoned commercial, and it is reasonable to expect that this zone will be expanded to accommodate future demands for commercial and/or industrial property.

With regard to Line C, commercial and/or industrial development could be expected to occur at Hobart Street and at Congress Street. At the present time no zoning changes are anticipated in these areas; however, if Line C is built, this attitude may change.

If the above expansion of the commercial and/or industrial zones occurs in these areas for any of the lines, the abutting residential properties that remain next to the expanded zones may decrease in value. It is also true that the increased commercial and/or industrial properties will add to the tax base and residential property, not abutting or close to, but within easy access of these interchanges, may also increase in value and add to the tax base of Portland.

4. Retail Trade

The impact of the Westbrook Arterial on retail trade can be discussed in two general categories: the effect on highway-oriented businesses and the effect on nonhighway-oriented businesses. Each of the alternate lines for the Arterial will have a varying impact on Brighton Avenue traffic. The majority of highway-oriented retail sales outlets along Brighton Avenue are located between the Westbrook Connector and the Portland Connector. These businesses would be more sensitive to changes in traffic volumes on Brighton Avenue.

Depending on which alternate is selected, traffic reduction in this area would vary from a low of about 18% for Line C to a maximum of about 52% for Line A, based on 1974 estimates. Based on comparison with 1994 traffic volumes on Brighton Avenue without the Arterial, Line C would reduce traffic by about 24%; Lines B and B-1 by 48%, and Line A by 55%. However, much of the traffic removed to the Arterial would be commute-to-work traffic, less inclined to patronize those highway-oriented businesses in the vicinity of Turnpike Exit 8 such as the motel-restaurant complexes.

A decline in income, due to the arterial, for these highway and transient-oriented businesses is not expected to be significant. All of the service stations along Brighton Avenue will likely lose some of their commuter gasoline sales. Sales volume for the nonhighway-oriented businesses may very well increase, particularly for the section of Brighton Avenue near the Turnpike exit. The variety of enterprises, many of which have regional attraction,

will contine to provide a strong economic base. The Arterial, in addition to relieving traffic congestion on Brighton Avenue, will also significantly improve access to this highly developed shopping area.

Businesses easterly of the Portland Connector are more characteristic of convenience-type neighborhood stores; however, some of the specialized service enterprises have a more regional service area. These businesses are more likely to experience increased sales as a result of the improved accessibility due to reduced congestion.

The only other significant concentration of commercial activity is at the Westgate Shopping Mall at the intersection of Congress Street and Stevens Avenue (Bradley's Corner). Sales volumes here may also increase, through improved access to and from the Arterial, as compared to Brighton Avenue.

5. Historic Elements

While Line A has no significant impact on the historic elements of the study area, the remaining alternates impact these features to some degree.

Line B has the most severe impact on the former Cumberland and Oxford Canal. It physically displaces approximately 5,600 feet of the original Canal site. If Line B were chosen for the Westbrook Arterial, the establishment of the proposed historic-recreation site along the Canal would not be feasible.

Although Line B-1 eliminates approximately 3,000 feet of the abandoned canal line to the east, this displacement would not interfere with the establishment of the proposed historic-recreation site along the remaining portion of the Canal in the study area. Line B-1 is cut into the upland to the north of Stroudwater Road and parallels the alinement of the Canal site in this vicinity, crossing it further to the west. It would be possible to establish a riding and walking trail within the right-of-way of the Arterial as it parallels the Canal in this vicinity. Access to the path and to the remaining Canal site and locks to the west could be provided from Westbrook Street, Congress Street or the Portland Connector. These steps have a tendency to minimize the adverse impact of Line B-1 on the Canal site and possibly stimulate the development of other facilities (picnic tables, canal boat operation, museum) suggested by Professor Joel Eastman in his proposal to the Greater Portland Council of Governments.

Line C also has a significant adverse impact on the Canal. The line crosses the former Canal at a point where, according to information supplied by Professor Eastman, the remains of some of the old locks are located (Figure 15 on page 47). The fill which would be placed over these locks would destroy this area of historic interest.

A significant social impact of Line C also occurs in relation to the Stroudwater Historic District. As Line C emerges from the Fore River tidal marshes, and passes between the boundaries of the Stroudwater Historic District and the Portland Jetport, it displaces the Francis Fickett House at 1141 Westbrook

Street. Although the Francis Fickett House is not encompassed by the Historic District boundaries, it was included in the application as having historic value and should be viewed in this fashion.

Mr. James H. Mundy, the State Historic Preservation Officer, has concluded that Line A would have no impact on the Stroudwater Historic District; that Lines B and B-1 would be acceptable if they were properly bermed and landscaped, and that Line C would produce a detrimental impact on the Stroudwater Historic District in that it would increase commercial development pressure in the area as well as significantly altering the visual environment through construction of a bridge across the Fore River.

Mr. Mundy has also noted that the site of the former Canal, in the study area, is of little historic value due to its deteriorated condition. Mr. Mundy does not feel that the loss of this site is significant.

There have not been any archaeological points of significance noted to date in the study area. However, provisions could be made in the construction contract which would provide for archaeological exploration of the area if it was found to be significant.

6. Institutional

The proposed action will have no significant impact on institutional facilities, such as schools, churches or hospitals, either in the study area or the remainder of the City of Portland.

B. VISUAL

1. All Lines

For those individuals who presently use the common portion of the Westbrook Arterial area for hiking, horseback riding, and other recreational pursuits, the Arterial will have an adverse visual impact. Suitable plantings will be made in an attempt to reduce this impact. Here, as throughout, the adverse visual impacts of the road can be minimized by landscaping and selective thinning.

2. Line A

Line A will have an adverse visual impact on the homes that remain at the end of Winding Way, Riverview Street, Bancroft Court, Frost Street, dead-ended Congress Street, Mitton Street, Powsland Street and Sewall Street.

At the present time the homes located at the end of Winding Way and Riverview Street and a few homes on Capisic Street have an unobstructed view of the Fore River wetlands in this vicinity. If Line A were constructed it would have an adverse impact on the view of the marshes from these areas.

The homes remaining at the cul-de-sac on old Congress Street would be visually impacted on the south by the Arterial and on the northwest by the relocated Congress Street. The relocation of Congress Street would have the impact of adding a man-made feature into the relatively natural environment to the rear of these homes.

The visual impact on the homes remaining at the ends of Frost Street, Mitton Street, Powsland Street and Sewall Street would be minor in the sense that the present view is less significant.

3. Line B

The visual impact of Line B would be significantly adverse for those residents whose homes presently overlook the Fore River estuary. This would include some homes on Fenway Street, Congress Street, Brewer Street, Riverview Street, Capisic Street and Winding Way on the north side of the channel, and Westbrook Street, Penrith Road, Roundabout Lane and Stroudwater Road on the south side of the channel. This adverse impact would be most severe for the homes located on the banks of the Fore River in the Stroudwater Historic District. At present, these homes have an unobstructed view of the Fore River wetlands, and the introduction of the Arterial into this natural scene would be alien to this setting. Line B also eliminates any visual evidence of the abandoned Cumberland and Oxford Canal along much of its length in the study area.

4. Line B-1

The visual impact of Line B-1 will be similar to that of Line B. The major difference for Line B-1 is that it does not displace as much wetland as does

Line B and does not interrupt as much of the visual contact with the abandoned Cumberland and Oxford Canal. By shifting the more easterly portion of Line B-1 onto the upland sooner than Line B, the visual impact on the Fore River wetlands is reduced, especially for those residents of Fenway Street and Westbrook Street. However, the visual impact on these homes is still considered adverse and significant due to the disruption of the natural scenery.

5. Line C

Line C also has an adverse visual impact on the homes having a view of the Fore River estuary in an easterly direction. This impact is most severe on the homes on the banks of the Fore River north of Westbrook Street in the Stroudwater Historic District.

As Line C moves out of the wetlands in a southerly direction it parallels the Stroudwater Historic District boundary. However, the visual impact is minimized as the Arterial is in a 20-foot cut in this vicinity. The remaining length of Line C divides rural Stroudwater and introduces a large manmade element into an otherwise pastoral scene.

C. AIR

Summaries of air quality estimates for the 38 selected zones (Figure 17, page 61) are presented in Tables 23 and 24. The 1-hour and 8-hour maximum CO concentrations shown result solely from the adjacent road segments. These estimates indicate that no violations of standards will occur for any alternate for the set of conditions given previously in the description of methodology. These estimates also suggest that Zones 1, 2, 3, 5 and 9, because of their relatively high concentrations, should be selected for additional computations of air quality based on all upwind sources. In addition, 1-hour and 8-hour CO predictions were made for four sensitive receptors which were identified as potential high concentration sites.

The estimates given in Tables 23 and 24 can also be used to compare the improvement or degradation of the local environment resulting from the selection of the various alternates.

The 38-zone analysis indicates that, for the 22 zones which include the existing roads, estimates of CO concentrations are lower for the "build" alternates than for the Do-Nothing alternative, except for the following cases:

Line A--1994 maximum 1- and 8-hour concentrations in Zone 8
Line C--1974 and 1994 maximum 1- and 8-hour concentrations in Zone 15

For Line A, in 1994, Stevens Avenue south of Frost Street (Zone 8), would experience a slight degradation in air quality. This is a result of the increase in traffic (11% in 1974 and 36% in 1994 as compared to the Do-Nothing alternative) due to the dead-ending of Frost Street. For Line C in 1974, Congress Street, immediately south of the interchange (Zone 15), would experience a 30% increase in both 1-hour and 8-hour concentrations. By 1994, the concentrations would be only slightly higher than for the no-build option. In all cases, however, the increased concentrations would still be well below the standards.

A comparison of the zonal estimates indicates that the air quality on Brighton Avenue, between the Turnpike and Stevens Avenue (Zones 1, 2 and 3), generally improves as the Westbrook Arterial alinement is moved closer to Brighton Avenue. Line A would generally cause only 60% of the carbon monoxide that Line C would cause. The best air quality on Congress Street results from Line C, except for Zone 9 which experiences the lowest concentrations for Line B or B-1 and Zone 15 (discussed above) which has lowest concentrations for Line A.

As expected, pollutant concentrations for all zones adjacent to the proposed routes and the Westbrook and Portland Connectors will be greater for "build" alternates than for the Do-Nothing alternative; however, the proposed roads are generally routed through undeveloped areas and are sufficiently distant from high density residential districts to have only a minor impact. Further, the proposed routes are downwind of the heavily urbanized area for winds from the west to northwest which prevail during the winter and for off-shore night wind regimes when conditions are most conducive to high pollutant concentration.

Despite increasing traffic volumes, estimates for carbon monoxide will be considerably lower in 1994 versus 1974 for all zones as a result of progress in motor vehicle emission abatement.

Ambient CO concentrations due to non-vehicular sources are not expected to be significant. Major ambient air pollutant contributors include the Portland International Jetport and S. D. Warren Company, a paper products mill situated immediately west of the study area.

In 1972, according to the Airport Master Plan Report, activities at Portland International Jetport generated approximately 390 tons of pollutants, including about 323 tons of CO. The total pollutants and the CO are based on ground operations plus airborne operations below 3,000 feet. The CO is nearly 13% of the CO emissions from major roadways in the project area; however, the contribution is not significant since the airport is downwind of the study area for the low wind speeds from the northwest which are used generally in the analysis. The contribution of CO from S. D. Warren Company is approximately one-quarter that of the airport. Due to their locations relative to the study area, each contributor is considered separately, and the effects cannot be considered additive. In terms of micro-scale analyses, the increase over the predicted concentrations is considered to be minimal.

Compensating factors should ensure that the concentrations presented here do not underestimate actual concentrations. The climatological conditions assumed in this study are highly unfavorable for the dispersion of pollutants and may not be expected to occur frequently. Average climatological conditions would yield considerably less than the maximum concentrations presented.

The estimates based on consideration of all upwind sources for Zones 1, 2, 3, 5 and 9 are given in Table 25. The analysis does not establish significant differences between the "build" alternates but does clearly indicate that all "build" alternates yield substantial air quality improvement over doing nothing. The 5-zone analysis estimates indicate only one violation--1974/8-hour maximum/Do-Nothing/Zone 2. The 1994 estimates are not presented in Table 25 because they are generally in the order of one-third those of 1974; thus, no violations will occur.

The sensitive receptor analysis is presented in Table 26. All estimates at sensitive receptors are below standards. The St. Patrick School, with the highest concentrations of all receptors, shows at least a 14% decrease in concentrations as a result of the "build" alternates. The greatest improvement to the St. Patrick School will result from Line B or B-1 while the other three receptors should experience the best air quality under Line A. As was the case for the zonal analyses, the 1994 estimates are not presented since they are considerably lower than the 1974 predicted concentrations, and would not result in violations.

Table 23

POTENTIAL MAXIMUM 1-HOUR CARBON MONOXIDE - PPM*

Zone**	1974				1994			
	D-N	A	B, B-1	C	D-N	A	B, B-1	C
1	6.9	3.0	3.6	5.0	2.2	0.8	1.0	1.4
2	6.9	3.0	3.6	5.0	2.2	0.8	1.0	1.4
3	5.2	2.6	3.0	3.9	1.9	0.9	1.0	1.4
4	2.4	1.8	1.8	2.2	1.0	0.7	0.7	0.8
5	5.2	2.3	2.6	3.6	1.8	0.7	0.7	0.9
6	2.7	2.5	2.2	1.6	0.8	0.8	0.8	0.6
7	2.0	---	1.4	1.0	0.7	---	0.5	0.3
8	3.5	3.5	1.9	2.7	1.1	1.2	0.5	0.7
9	8.9	5.3	3.8	4.5	3.4	1.5	1.5	1.3
10	4.7	---	3.6	1.4	2.9	---	1.5	0.5
11	4.7	---	2.7	1.0	1.8	---	1.0	0.4
12	4.7	---	2.7	1.0	1.8	---	1.0	0.4
13	4.7	2.6	3.2	1.0	1.8	1.1	1.2	0.4
14	3.0	1.6	2.3	1.1	1.1	0.5	0.8	0.4
15	3.0	1.6	2.3	3.9	1.1	0.5	0.8	1.3
16	1.2	1.1	1.1	0.3	0.5	0.4	0.4	0.1
17	2.2	0.2	0.3	0.2	1.0	0.1	0.1	0.1
18	---	0.8	0.8	0.6	---	0.2	0.2	0.1
19	---	1.1	1.1	1.6	---	0.4	0.4	0.5
20	---	4.5	4.3	3.3	---	1.7	1.5	1.4
M-N	1.9	1.9	1.9	1.9	1.1	1.1	1.1	1.1
R-S	4.6	4.6	4.6	4.6	1.1	1.1	1.1	1.1
1A	---	2.8	---	---	---	0.7	---	---
2A	---	2.8	---	---	---	0.7	---	---
3A	---	3.7	---	---	---	2.3	---	---
4A	---	2.7	---	---	---	1.0	---	---
5A	---	4.8	---	---	---	1.8	---	---
1B	---	---	2.7	---	---	---	3.3	---
2B	---	---	3.3	---	---	---	1.2	---
1B-1	---	---	1.5	---	---	---	0.2	---
2B-1	---	---	1.5	---	---	---	0.2	---
3B-1	---	---	3.3	---	---	---	1.2	---
1C	---	---	---	1.5	---	---	---	0.2
2C	---	---	---	3.7	---	---	---	0.6
3C	---	---	---	2.0	---	---	---	0.7
4C	---	---	---	0.7	---	---	---	0.7
5C	---	---	---	1.7	---	---	---	0.3
6C	---	---	---	3.2	---	---	---	0.7

* All concentrations are expressed in parts per million (PPM). The Federal Primary Standard for 1-hour CO is 35 PPM.

** Zones are shown on Figure 17, page 61. Offsets are shown in Table 14, page 60.
Where no predictions are shown (indicated by "---"), the zone does not exist for the alternate being addressed.

Table 24

POTENTIAL MAXIMUM 8-HOUR CARBON MONOXIDE - PPM*

	1974				1994			
Zone**	D-N	A	B, B-1	C	D-N	A	B, B-1	C
1	6.2	2.7	3.2	4.5	1.9	0.7	0.9	1.3
2	6.2	2.7	3.2	4.5	1.9	0.7	0.9	1.3
3	4.7	2.3	2.7	3.5	1.7	0.8	0.9	1.3
4	2.2	1.6	1.6	2.0	0.9	0.6	0.6	0.7
5	4.7	2.1	2.4	3.2	1.7	0.6	0.6	0.8
6	2.4	2.3	2.0	1.5	0.8	0.7	0.7	0.5
7	1.8	---	1.3	0.8	0.7	---	0.5	0.3
8	3.2	3.1	1.7	2.4	1.0	1.1	0.5	0.6
9	7.8	4.8	3.4	4.1	3.1	1.4	1.4	1.2
10	4.3	---	3.2	1.2	2.6	---	1.4	0.5
11	4.3	---	2.4	0.9	1.6	---	1.0	0.3
12	4.3	---	2.4	0.9	1.6	---	1.0	0.3
13	4.3	2.4	3.0	0.9	1.6	1.0	1.0	0.3
14	2.7	1.5	2.1	1.0	1.0	0.5	0.7	0.3
15	2.7	1.5	2.1	3.5	1.0	0.5	0.7	1.2
16	1.1	1.0	1.0	0.3	0.5	0.4	0.4	0.1
17	1.9	0.2	0.3	0.2	0.9	0.1	0.1	0.1
18	---	0.6	0.6	0.5	---	0.2	0.2	0.1
19	---	0.9	0.9	1.3	---	0.3	0.3	0.4
20	---	3.5	3.3	2.6	---	1.3	1.2	1.1
M-N	1.4	1.4	1.4	1.4	0.8	0.8	0.8	0.8
R-S	3.6	3.6	3.6	3.6	0.9	0.9	0.9	0.9
1A	---	2.2	---	---	---	0.5	---	---
2A	---	2.2	---	---	---	0.5	---	---
3A	---	2.9	---	---	---	1.0	---	---
4A	---	2.4	---	---	---	0.9	---	---
5A	---	4.3	---	---	---	1.6	---	---
1B	---	---	2.1	---	---	---	0.6	---
2B	---	---	2.6	---	---	---	0.9	---
1B-1	---	---	1.2	---	---	---	0.2	---
2B-1	---	---	1.2	---	---	---	0.2	---
3B-1	---	---	2.6	---	---	---	0.9	---
1C	---	---	---	1.2	---	---	---	0.2
2C	---	---	---	2.9	---	---	---	0.5
3C	---	---	---	1.6	---	---	---	0.5
4C	---	---	---	0.5	---	---	---	0.5
5C	---	---	---	1.3	---	---	---	0.2
6C	---	---	---	2.5	---	---	---	0.5

* All concentrations are expressed in parts per million (PPM). The Federal Primary Standard for 8-hour CO is 9 PPM.

** Zones are shown on Figure 17, page 61. Offsets are shown in Table 14, page 60.
Where no predictions are shown (indicated by "---"), the zone does not exist for the alternate being addressed.

Table 25

CUMULATIVE IMPACT ON ALL UPWIND ROADS ON SELECTED ZONES IN 1974

1-Hour Maximum Carbon Monoxide (PPM)

Zone	Do-Nothing	Line A	Lines B, B-1	Line C
1	7.4 (W)*	4.7 (W)	5.4 (W)	6.6 (W)
2	12.2 (SE)	7.3 (SE)	7.7 (SE)	7.5 (SE)
3	8.9 (SE)	6.0 (SE)	6.5 (SE)	5.4 (SE)
5	8.1 (SE)	6.1 (S)	5.8 (S)	3.6 (SE)
9	9.8 (SE)	7.8 (N)	6.2 (W)	6.4 (W)

8-Hour Maximum Carbon Monoxide (PPM)

Zone	Do-Nothing	Line A	Lines B, B-1	Line C
1	5.9	3.8	4.4	5.3
2	9.6	5.9	6.3	5.9
3	7.1	5.0	5.3	4.3
5	6.5	5.2	5.0	2.8
9	8.8	6.2	5.0	5.0

* Wind directions are shown in parenthesis. Wind directions for the 8-hour maximum are the same as for the 1-hour maximum.

Table 26

SENSITIVE RECEPTOR ANALYSIS FOR 1974

Carbon Monoxide - PPM

Receptor	Do-Nothing		Line A		Lines B, B-1		Line C	
	1-Hr.	8-Hr.	1-Hr.	8-Hr.	1-Hr.	8-Hr.	1-Hr.	8-Hr.
City Hospital	2.8	2.2	2.9	2.5	3.0	2.4	3.2	2.6
St. Patrick School	9.1	7.0	7.8	6.2	6.2	5.0	6.4	5.0
Resource & Audio-Visual Center	7.3	5.7	3.4	2.7	4.0	3.2	5.5	4.3
Roosevelt School	3.8	3.0	2.8	2.2	2.9	2.2	3.0	2.3

The results of the meso-scale analysis are presented in Table 27. The 1974 estimates assume the existence in 1974 of the proposed alternates. All the pollutant estimates are based solely on highways within the study area.

Table 27

MESO-SCALE (AREA-WIDE) AIR POLLUTANT ESTIMATES*

	Pollutant					
	CO		HC**		NOx	
	1974	1994	1974	1994	1974	1994
Do-Nothing	2626	930	436	168	441	290
A	2463	790	439	156	500	320
B, B-1	2402	775	426	153	482	308
C	2483	809	441	158	495	316

* All pollutant burden estimates are expressed in tons per year.
** HC estimates include both non-methane (reactive) and methane (non-reactive.)

Construction of any one of the "build" alternates will cause a reduction in total emissions of CO, will not significantly affect HC emissions, and will produce a slight increase in total emissions of NOx due to the increase in vehicle speeds. As a general statement, there would be no significant difference in total pollutant burden whether a new roadway is built or not.

All 1994 estimates are lower than 1974 estimates for CO, HC, and NOx despite the projected increase in traffic. The lower concentrations result from the virtual elimination of uncontrolled vehicles on the road.

Air pollutant estimates indicate that no significant adverse effects may be expected due to pollutants generated as a result of the proposed construction. In fact, enhacement of the ambient air quality would occur in many areas, including Brighton Avenue, Capisic Street, Westbrook Street, and most of Congress Street.

During the construction phase, temporary deterioration of ambient air quality can be anticipated adjacent to and downwind of the construction site. Although dust from construction operations will be the primary concern, generation of air contaminants by construction equipment and higher emissions from automobiles during possible traffic delays could introduce an increased air pollutant burden to the project area.

The Federal Highway Administration has adopted interim regulations, as published in the Federal Register on September 5, 1973, to ensure that highway construction is consistent with approved plans for the implementation of any air quality standard in any air quality control region. The regulations require the review of the proposed action by the cognizant air pollution control agency. On May 2, 1974, the Maine Department of Environmental Protection, Bureau of Air Quality Control was consulted with regard to the Westbrook Arterial proposal. The discussion included a description of the methodology, the ambient air quality in the study area, traffic volumes, and the results of preliminary carbon monoxide predictions which indicated that standards would not be violated. At this time it was concluded that the proposal would be consistent with the State Implementation Plan. The Bureau of Air Quality Control will issue any further comments upon review of the Draft Statement during the formal comment period.

Recent Environmental Protection Agency regulations (40 CFR, Part 52), as published in the Federal Register on July 9, 1974, address the subject of indirect sources of air pollution. The Federal indirect source regulation requires all state implementation plans to have indirect source review procedures to prevent construction which will interfere with attainment or maintenance of ambient standards. The Westbrook Arterial, with anticipated traffic volumes in excess of 20,000 vehicles per day, is considered to be an indirect source that must comply with the above regulation.

As a result of the preceeding analyses it is concluded that construction of any one of the alternate alinements for the Westbrook Arterial will be consistent with the State Implementation Plan and will not interfere with the attainment and maintenance of national ambient air quality standards.

D. NOISE

Figures 26 through 28 (pages 141-143) depict ambient noise contours determined from both the ambient noise survey and predicted noise levels based on 1974 design hourly volumes on the existing street network. Predicted L_{10} noise contours based on projected 1994 design hourly volumes are shown on Figures 29 through 37 (pages 144-152) for Lines A, B, B-1, and C.

With respect to FHWA design noise level criteria of 70 dBA L_{10} for Category B land uses, the 70 dBA noise contour would fall approximately at the right-of-way line for the Westbrook Arterial alternates. Depending on which alternate is selected, between 3 and 12 residences within the project construction limits would be exposed to 1994 L_{10} levels in excess of 70 dBA (Table 28).

Impacts to the ambient noise environment were determined for each alternate by comparing ambient noise levels with predicted 1994 noise contours to locate areas subject to a significant increase over ambient levels. (The criteria for impact were shown previously in Table 16, page 67. A further differentiation of the "some impact" category of 6-15 dBA increase was used to determine increases of 6 to 10 dBA and 11 to 15 dBA, since the greater increase would be a somewhat more adverse impact.) Existing land use within each impact area was analyzed to determine the number of residences potentially affected. The noise contours as drawn do not take into account the noise reduction potential of natural topography or the effect of highway cuts and fills; however, the effects of topography, cuts and fills were evaluated for each potentially impacted structure to determine the final tabulation of impacts as summarized in the following table.

Table 28

SUMMARY OF NOISE IMPACTS
(number of Category B land uses impacted)

		(1994 Predicted L_{10}) minus (1974 Ambient L_{10})			
		Some Impact		Great Impact	
Alternate	1994 L_{10} greater than 70 dBA*	(6-10 dBA Increase)	(11-15 dBA Increase)	(15+ dBA Increase)	Total land uses impacted
A	8	26	9	2**	43
B	3	23	6	0	32
B-1	4	24	4	0	32
C	12	24	2	0	38

* With the exception of two residences under Line A and one residence under Line C, all of the impacted structures are presently exposed to L_{10} levels greater than 70 dBA and would remain so under the Do-Nothing alternative.

** These land uses would also be exposed to 1994 L_{10} levels greater than 70 dBA and are included in the total shown in that impact category.

1. Line A

Line A would result in L_{10} noise levels exceeding FHWA design noise level criterion for Category B land use at 8 residences; however, 6 of the structures are presently impacted (i.e., 1974 ambient L_{10} is greater than 70 dBA) and would remain so under the Do-Nothing alternative. These structures are located along Congress Street and at the Congress Street-Stevens Avenue intersection. Because the streets are at-grade and access to the properties is to be maintained, there is no opportunity to incorporate noise abatement measures into the proposed design. The Bureau of Highways would request an exception to the design noise levels for these residences. The remaining 2 land uses, at the end of Winding Way, are adjacent to the Arterial on new location. In addition to exceeding 70 dBA, the 1994 L_{10} noise levels at these residences also represent an increase of more than 15 dBA over 1974 ambient levels.

For Line A, 1994 L_{10} noise levels will result in increases over ambient levels on Winding Way of 6-10 dBA at 8 residences; increases of 11-15 dBA at 2 residences; and increases of more than 15 dBA at 2 residences. (The 2 homes subjected to increases of more than 15 dBA will also be exposed to 1994 L_{10} levels greater than 70 dBA, as described in the preceding paragraph.) As proposed, Line A would be approximately at the same elevation as Winding Way, thus noise abatement measures such as an earth berm or barrier, sufficient to provide at least 10 dBA reduction in noise level could effectively eliminate the noise impact in this area.

The deep cut proposed for Line A on the northwest side of the Congress Street interchange would effectively eliminate any significant impacts to the ambient environment in the residential area south of Capisic Street and west of Frost Street.

At the eastern end of Hobart Street, Line A 1994 L_{10} noise levels will result in increases of 6-10 dBA over ambient levels at 5 residences and an increase of 11-15 dBA at one residence. At the southerly ends of Lassell, Mitton and Powsland streets, increases of 6-10 dBA would result at 13 residences and increases of 11-15 dBA would occur at 6 residences. Line A as proposed is essentially at the same elevation as these residences; an earth berm or solid wall barrier could effectively eliminate the impact. However, proximity to the railroad track on the south side of Line A would restrict available space for construction of an earth berm to reduce the impact to the Hobart Street area, unless easements could be acquired southerly of the tracks for barrier installation.

In summary, Line A would not result in a significant impact on the noise environment. Although an exception to the design noise levels would be required for 6 land uses, potential impacts to other developed land uses could be minimized.

2. Line B

Line B would result in L_{10} noise levels exceeding FHWA design noise levels for 3 Category B land uses located on Congress Street; however, these land uses are presently impacted and would remain so under the Do-Nothing alternative. These land uses are at each end of the proposed reconstruction of Congress Street and there is no opportunity to minimize the impact, since the street is at-grade and access to the properties is to be maintained. An exception to the design noise levels would be required.

On Stroudwater Road, increases of 6-10 dBA over ambient levels would result at 3 residences, and increases of 11-15 dBA would occur at 2 residences. Because of the topography these residences would overlook the Arterial and there is little chance to eliminate the impact; however, measures to reduce noise levels could be taken.

Ambient noise levels would be increased by 6-10 dBA at one residence on Cliff Street. Along Fenway Street and the end of Osgood Street, Line B would result in ambient increases of 6-10 dBA at 6 residences and increases of 11-15 dBA at 4 residences. At the end of Hobart Street, there would be 2 residences subjected to increases of 6-10 dBA. Because of the topography, noise abatement would not be readily achievable for the homes on Fenway Street.

Further east, Line B would impact the same general area in the vicinity of Powsland Street as would Line A. An estimated 11 homes would be affected by increases of 6-10 dBA; however, it appears feasible to eliminate the impact by construction of a berm or barrier.

In summary, Line B would require an exception to the design noise levels for 3 Category B land uses. With respect to impacts to the ambient noise environment, Line B offers the least abatement potential of the several alternates, resulting in "some impact" to 12 homes and a "significant impact" to 6 homes.

3. Line B-1

Line B-1 would result in L_{10} noise levels exceeding FHWA design noise level criteria for 4 Category B land uses on Congress Street. These land uses are presently impacted, and would remain so under the Do-Nothing alternative. As with Line B, there is no opportunity to minimize the impact and an exception of the design noise levels would be requested.

With respect to the ambient noise environment, Line B-1 would result in impacts to 3 homes on Stroudwater Road, 4 homes on Cliff Street, and one residence on Hobart Street. Increases in these areas are all in the 6-10 dBA range, the "some impact" category. Abatement measures do not appear feasible. An estimated 16 residences in the vicinity of Powsland Street would be exposed to increases of 6-10 dBA and 4 homes would be exposed to increases of 11-15 dBA; in this instance, provision of an earth berm or barrier appears feasible to eliminate the impact.

In summary, Line B-1 would necessitate an exception to the design noise levels for 4 Category B land uses. Increases in ambient noise levels could not be minimized readily at 8 homes, located on Stroudwater Road, Cliff Street and Hobart Street; these residences are all in the "some impact" category, however.

4. Line C

Line C would result in a total of 12 residences being exposed to an L_{10} in excess of 70 dBA; however, all but one of the homes are presently impacted and would remain so under the Do-Nothing alternative. These land uses are located along Congress Street; 3 at the proposed interchange near Johnson Street, and 9 near the interchange at Hobart Street. Because Congress Street will remain at-grade in front of these homes, and access is to be maintained, there is no opportunity to incorporate noise abatement devices into the project design. The Bureau of Highways would request an exception to the design noise levels for these land uses.

With respect to the ambient noise environment, Line C would increase noise levels by 6-10 dBA at 2 homes on Partridge Road; it appears feasible to minimize this impact with a berm or barrier. Line C as proposed south of the Stroudwater River would be a depressed section which would significantly reduce noise intrusion in that area, with the exception of 2 homes near the mouth of the river north of Westbrook Street, which would be subjected to increases of 6-10 dBA. It appears feasible to minimize this impact through use of a berm or barrier.

Line C would have "some impact" (increase in noise levels of 6-10 dBA) at 8 residences in the Fenway Street-Hobart Street area. Due to the complex highway geometry and topographic features, it does not appear feasible to completely eliminate the impact; however, measures could be taken to reduce noise intrusion.

In the Powsland Street area, an estimated 12 homes would be in the "some impact" category, and 2 residences will be exposed to a "significant impact". An earth berm or barrier would eliminate this impact.

In summary, Line C would necessitate an exception to the design noise levels for 12 Category B land uses. Ambient noise impacts in the "some impact" category could not be eliminated readily at 8 residences.

5. Effect on Existing Streets

Construction of any alternate will also have impacts beyond the immediate construction area. Based on projected 1994 traffic volumes on existing streets under each alternate, typical L_{10} noise levels were estimated for the zones (i.e., highway segments) shown on Figure 38, page 153. Where possible, these L_{10} levels are referenced to an ambient noise measurement site located within that zone. This analysis is summarized in Table 29 on page 154.

1974 AMBIENT L_{10} NOISE LEVELS

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Scale in Feet
0 200 400

FIGURE 26

1974 AMBIENT L_{10} NOISE LEVELS

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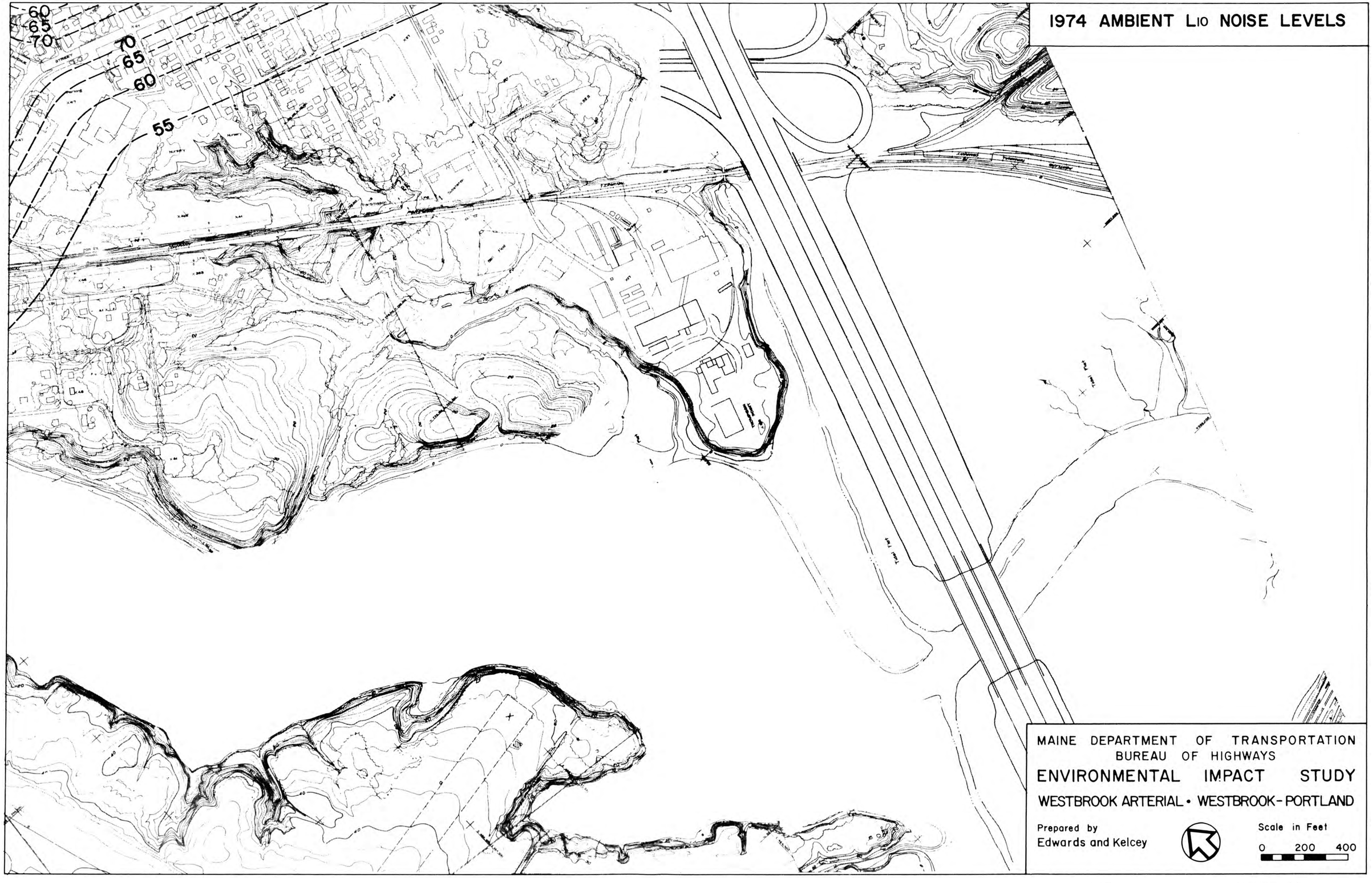
0 200 400

FIGURE 27

1974 AMBIENT L_{10} NOISE LEVELS



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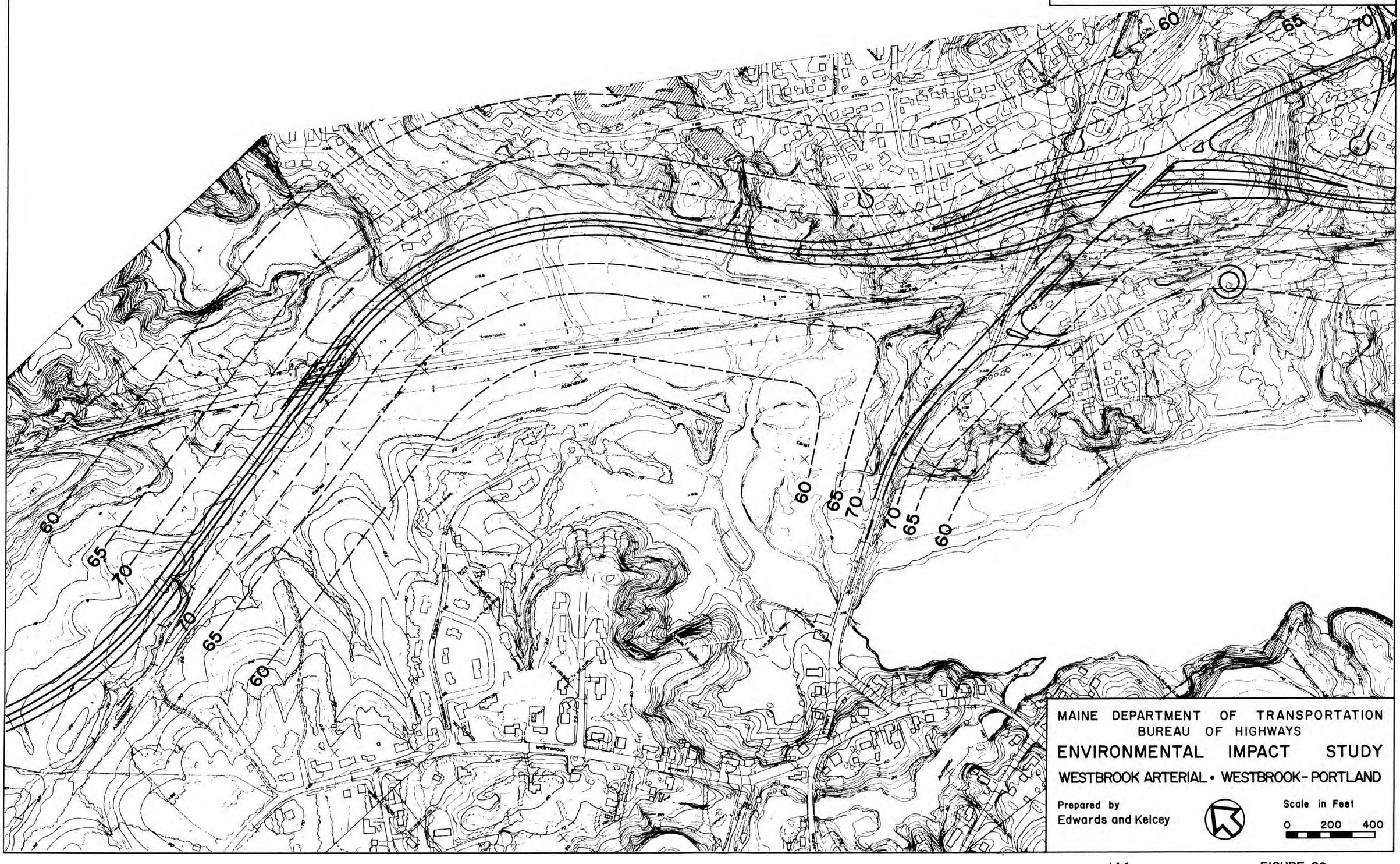
0 200 400

FIGURE 28

1994 PREDICTED L_{10} NOISE LEVELS
LINE A



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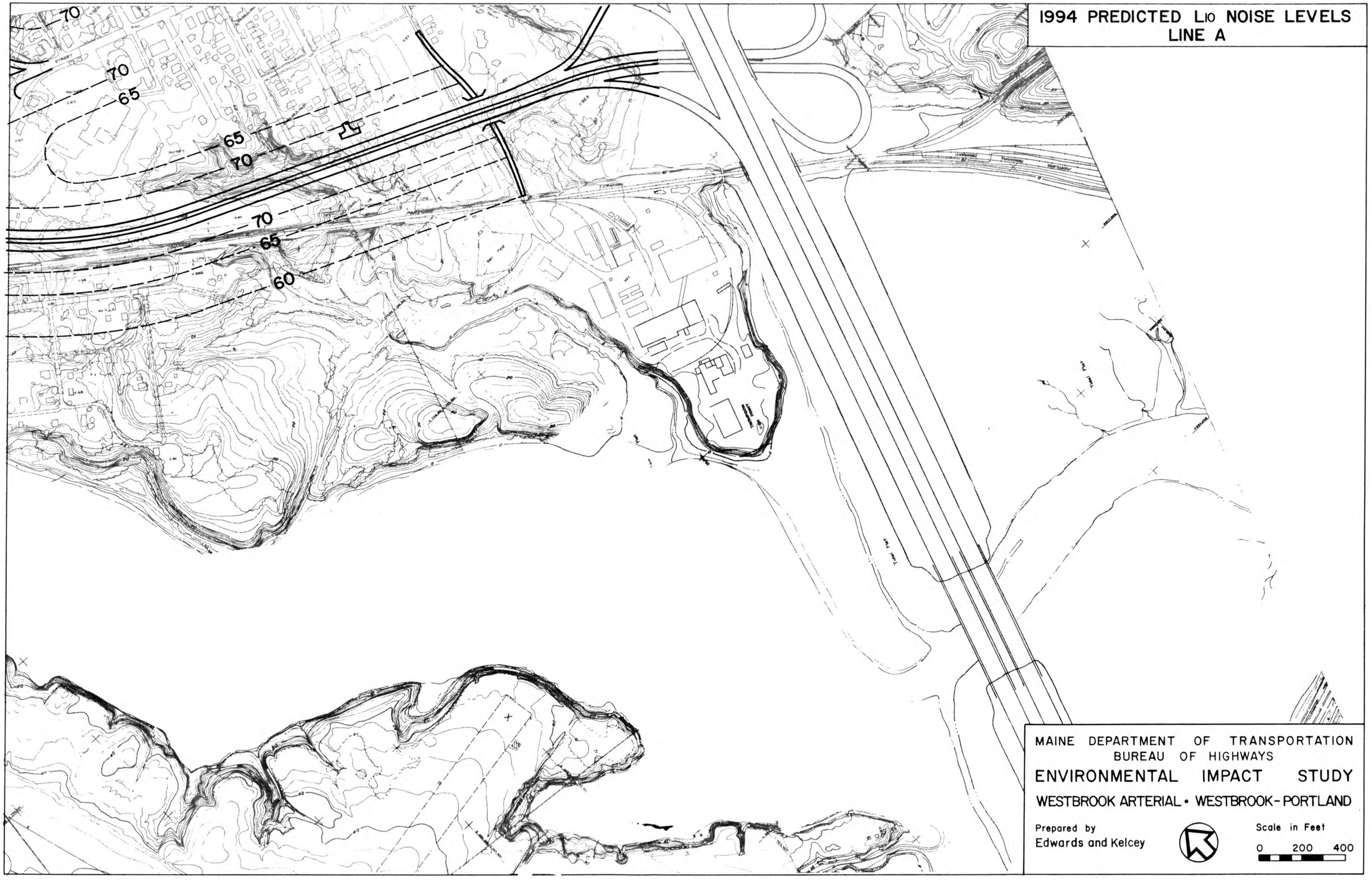
0 200 400

FIGURE 29


1994 PREDICTED L10 NOISE LEVELS
LINE A
70
70
65
65
70
70
65
60
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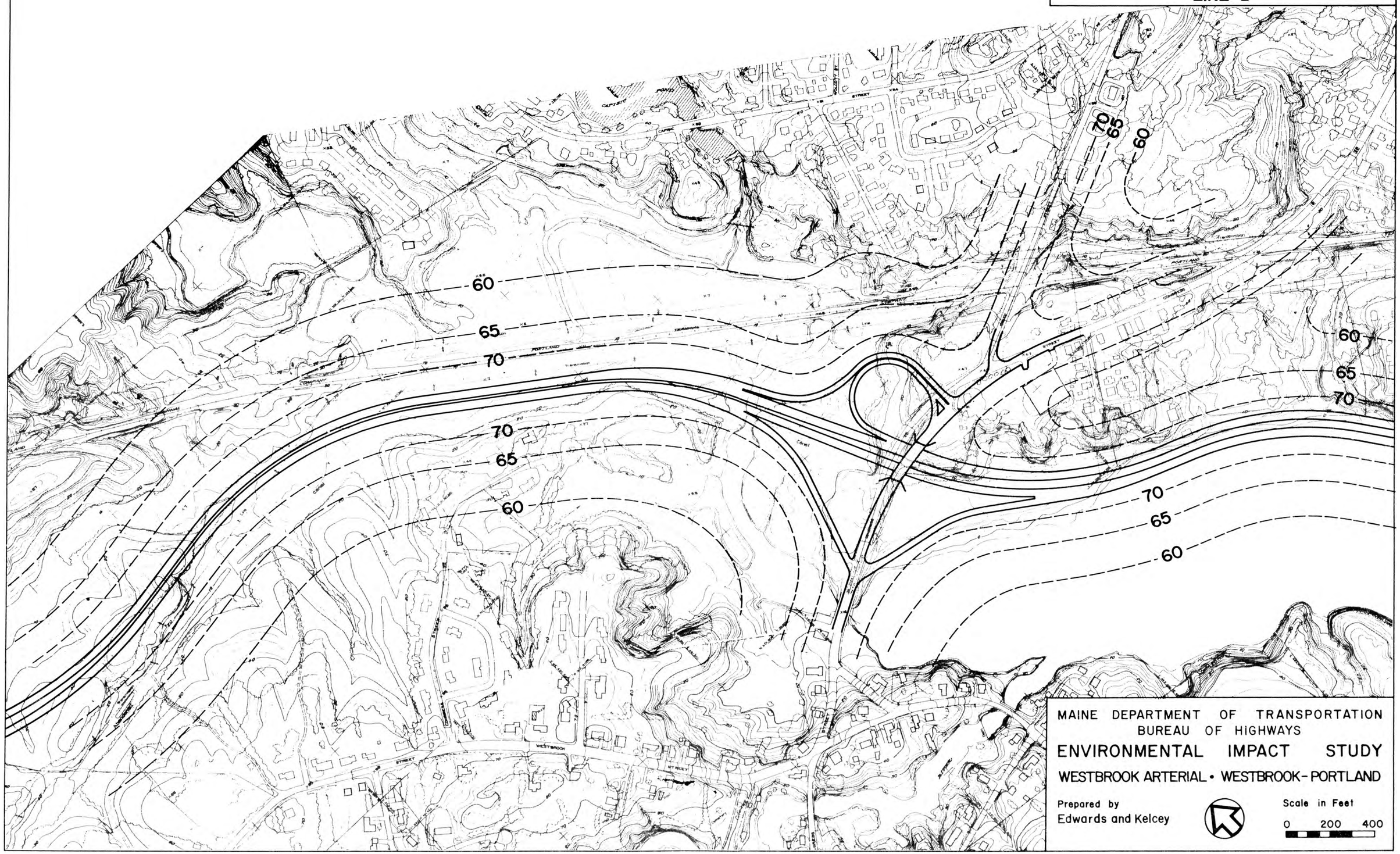
Scale in Feet
0 200 400

FIGURE 30

1994 PREDICTED L_{10} NOISE LEVELS
LINE B



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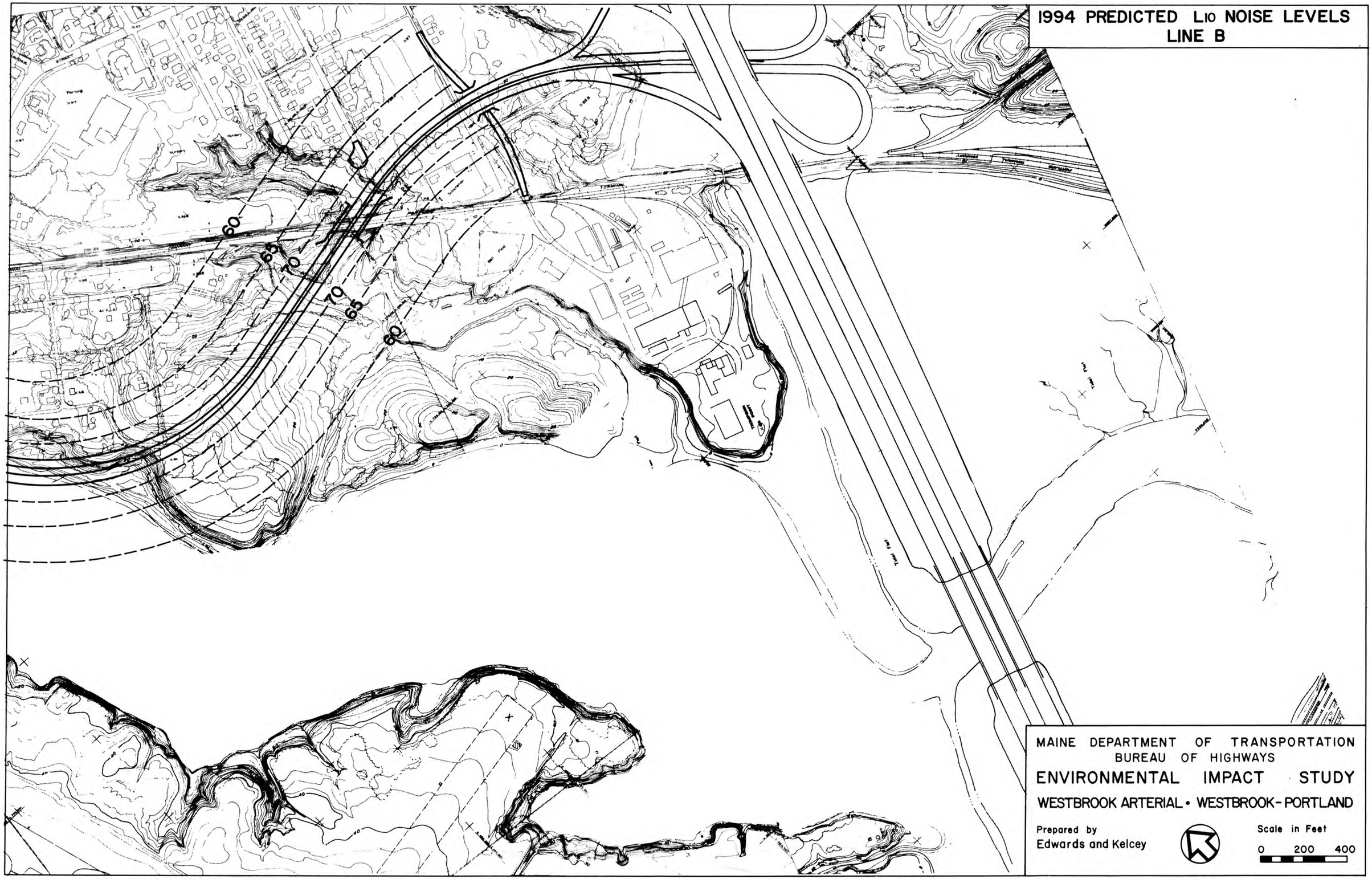
Scale in Feet
0 200 400

FIGURE 31

1994 PREDICTED L_{10} NOISE LEVELS
LINE B



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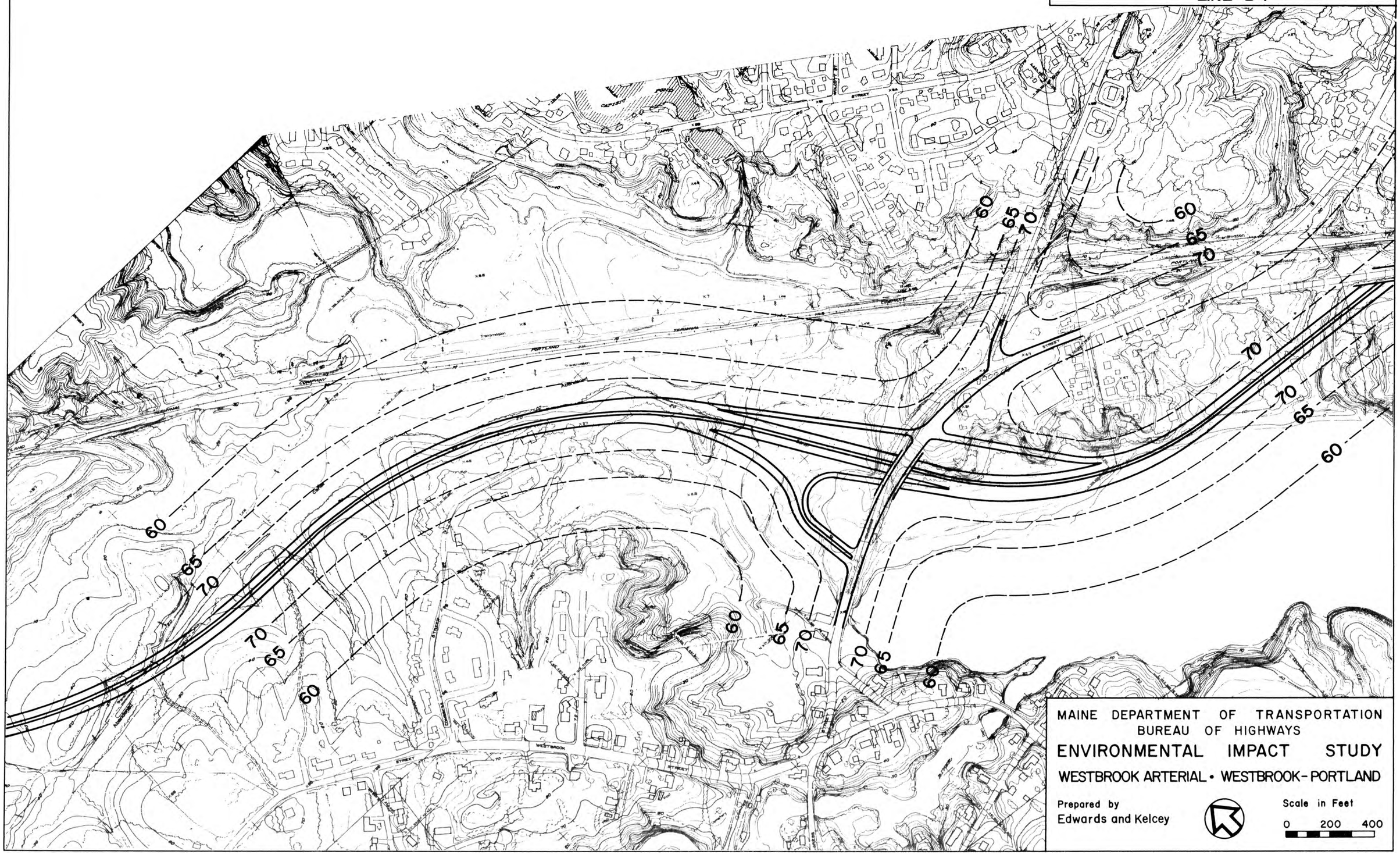
Scale in Feet
0 200 400

FIGURE 32

1994 PREDICTED L10 NOISE LEVELS
LINE B-1



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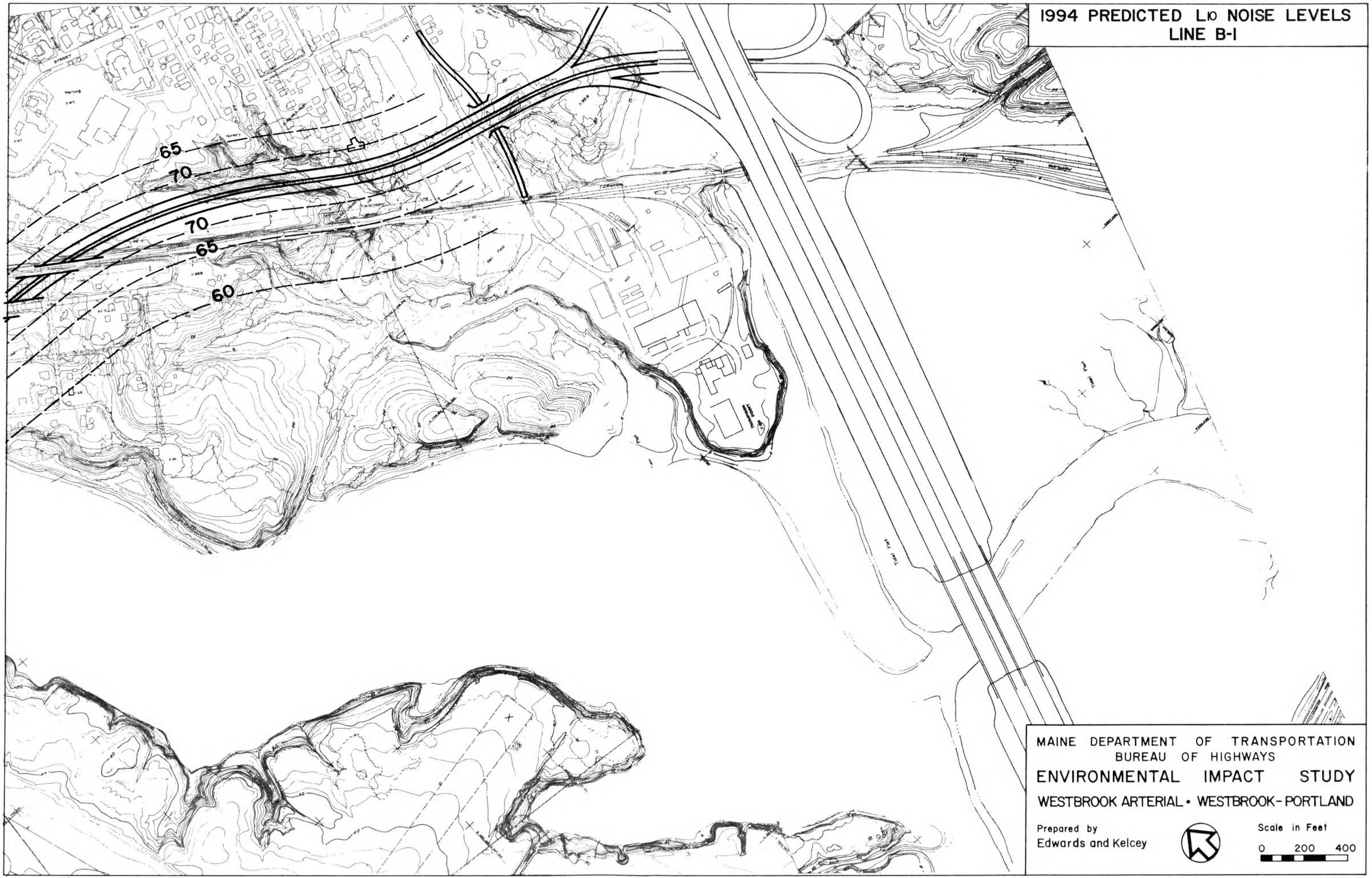
Scale in Feet
0 200 400

FIGURE 33


1994 PREDICTED L10 NOISE LEVELS
LINE B-1
65
70
70
65
60
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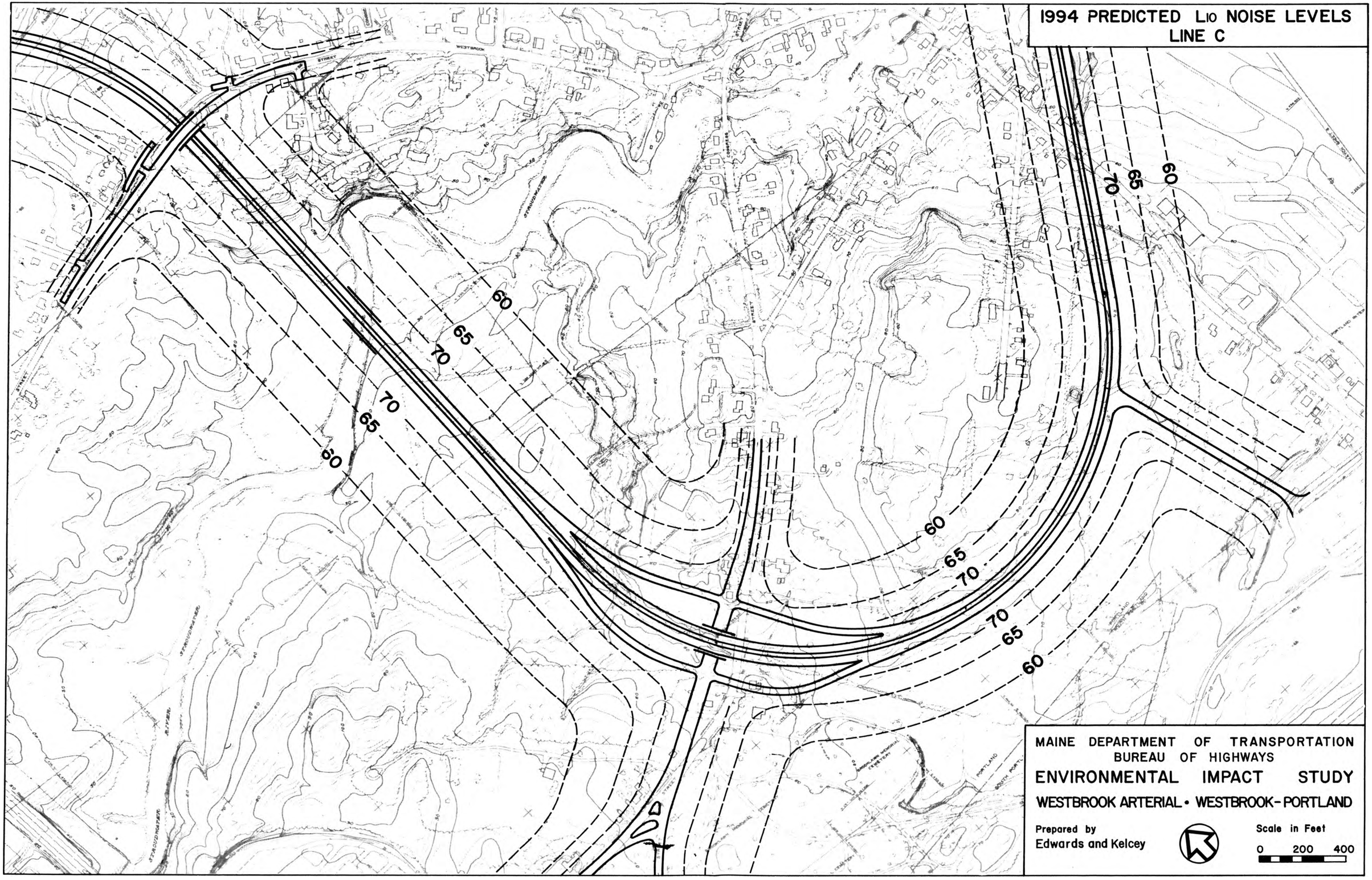
Scale in Feet
0 200 400

FIGURE 34


1994 PREDICTED L10 NOISE LEVELS
LINE C
60
65
70
MAINE DEPARTMENT OF TRANSPORTATION
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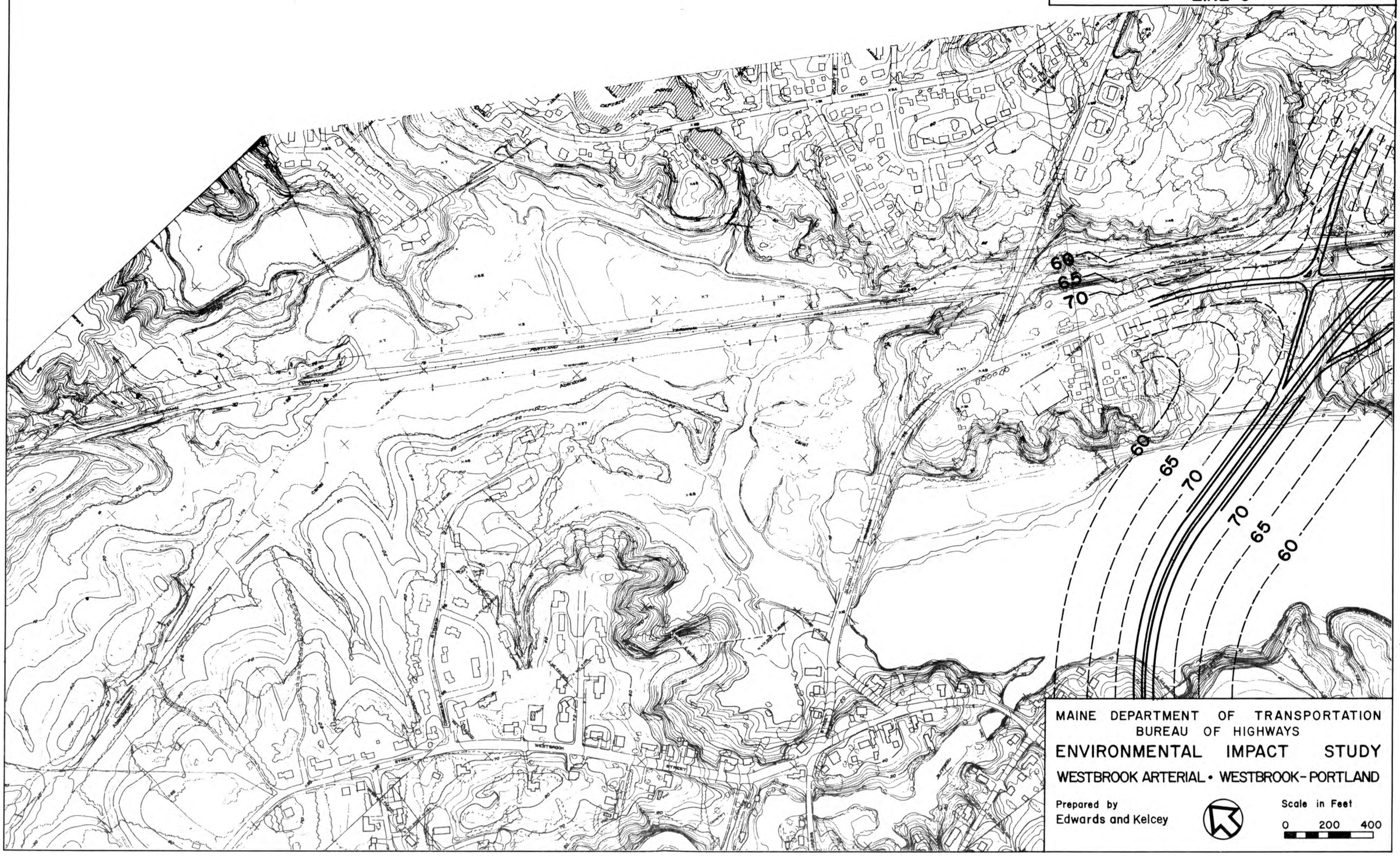
Edwards and Kelcey
Scale in Feet
0 200 400

FIGURE 35

1994 PREDICTED L_{10} NOISE LEVELS
LINE C



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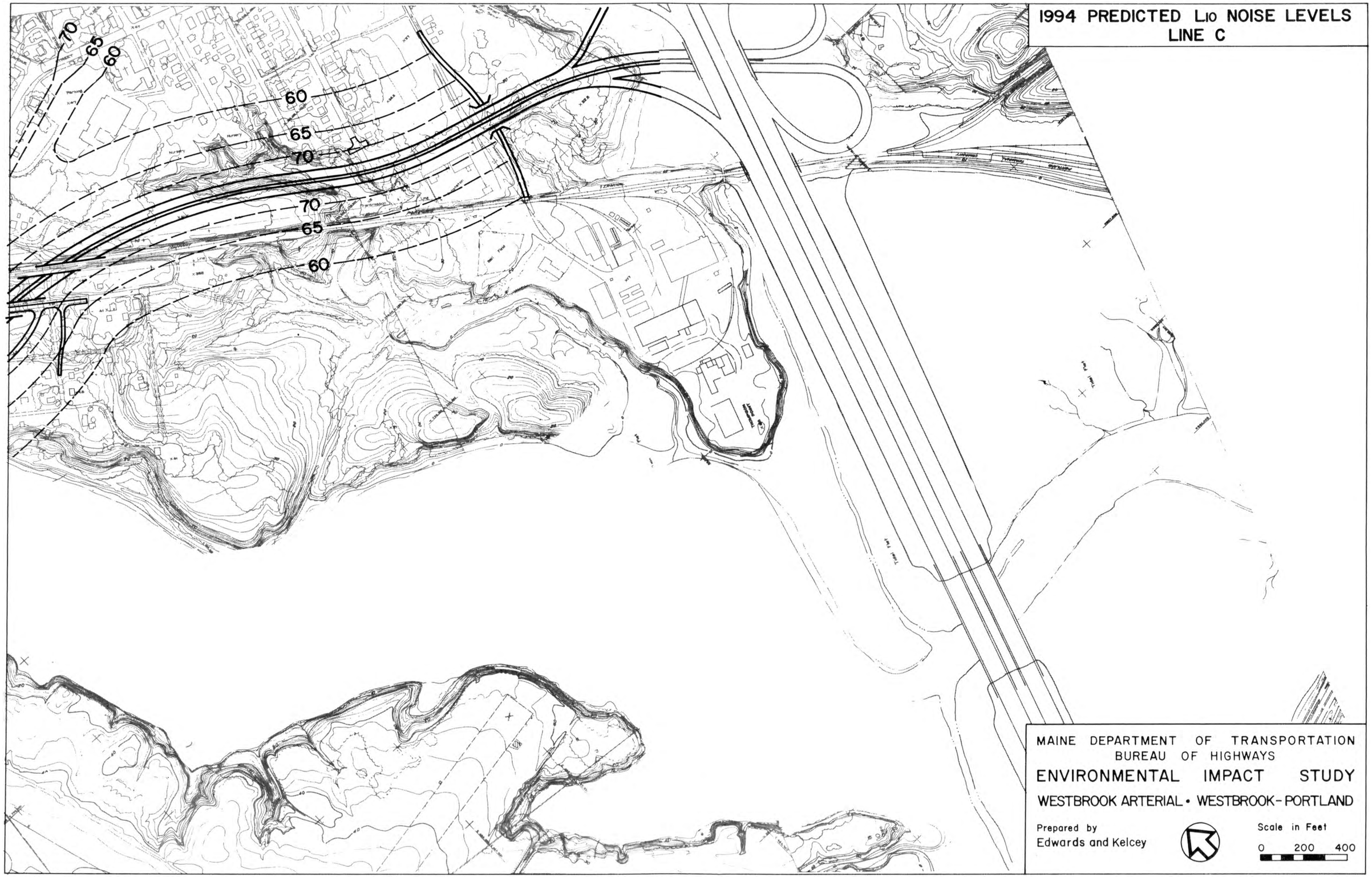
Scale in Feet
0 200 400

FIGURE 36


1994 PREDICTED L10 NOISE LEVELS
LINE C
70
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70
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60
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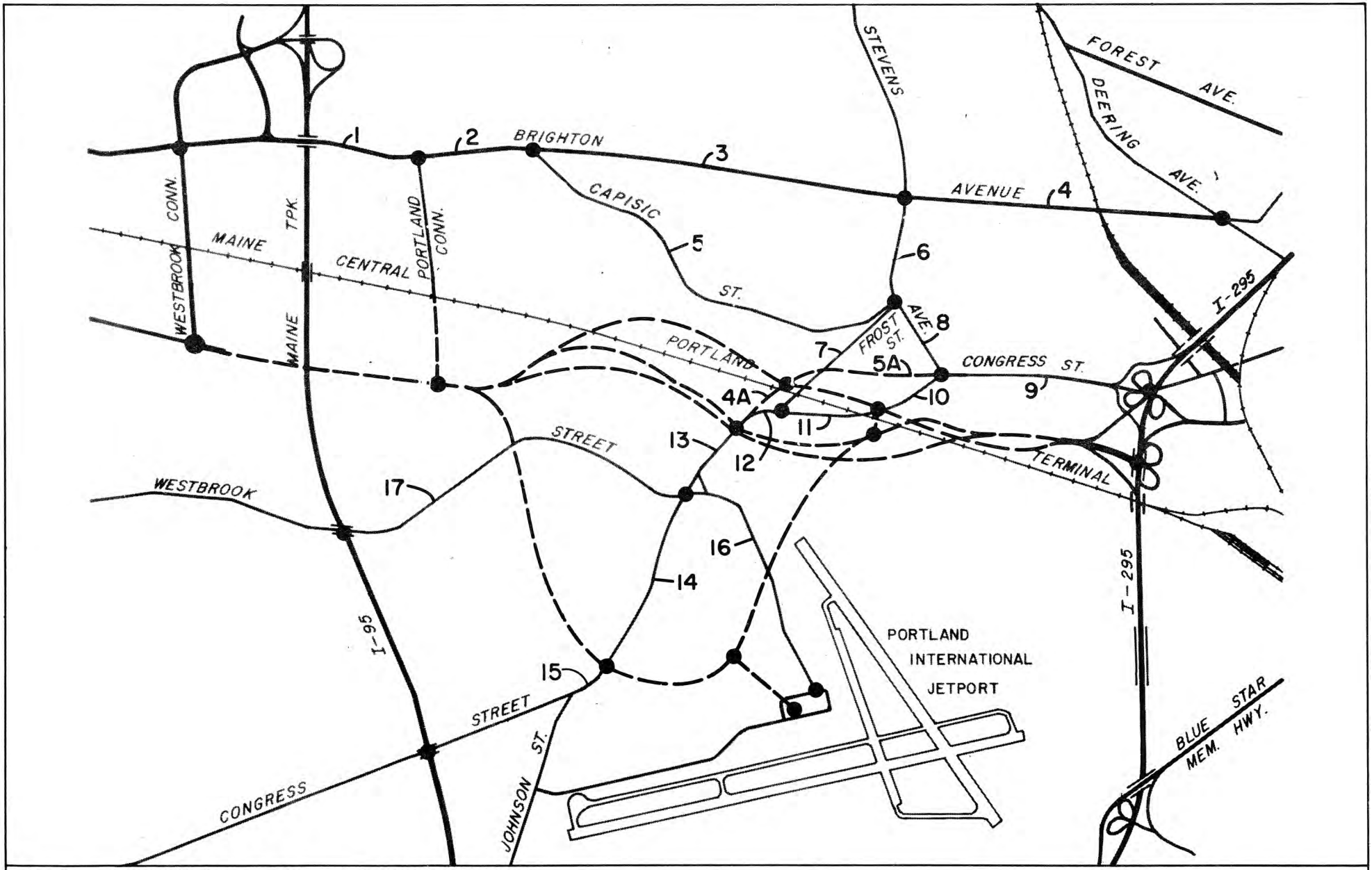
Scale in Feet
0 200 400

FIGURE 37



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NOISE ZONES

FIGURE 38

Table 29

NOISE LEVELS ON EXISTING STREETS - COMPARISON BY ALTERNATES

Street	Zone	1974 Ambient L_{10} Levels Site	Measured*	Peak**	1994 Predicted L_{10} Levels D-N	A	B, B-1	C
Brighton Avenue	1	A	74	74	76	70	71	74
	2	D	74	74	76	70	71	74
	3	U	72	72	74	70	71	74
	4	-	--	(67)	69	70	70	70
Capisic Street	5	JQ	68	69	71	68	68	69
Stevens Avenue	6	-	--	(64)	65	71	71	68
Frost Street	7	KP	73	73	75	--	73	71
Stevens Avenue	8	-	--	(68)	69	73	70	72
Congress Street	9	Y	70	71	73	71	70	70
	10	-	--	(73)	76	75***	74	73
	11	K	68	73	76	74***	74	67
	12	W	67	73	76	74***	74	67
	13	T	71	73	76	74	75	67
	14	AZ	72	72	74	69	71	67
	15	-	--	(72)	74	69	71	74
Westbrook Street	16	X	70	71	75	75	75	64
Westbrook Street	17	LN	67	68	71	61	61	61

* The values for Sites X and KP are at 30' offset; all others are at 60' offset.
** Values in parentheses are estimated peak ambient levels.
*** For Alternate A, (due to relocation of Congress Street) the value shown for zones 10 and 11 apply to zone 5A; the value for zone 12 applies to zone 4A.

The following Table 30 provides a summary of the data in Table 29 with respect to changes in ambient noise levels on existing streets outside of the immediate construction areas for each alternate.

Table 30

IMPACT TO AMBIENT NOISE LEVELS ON EXISTING STREETS*

Alternate	1994 Predicted L_{10} versus 1974 Ambient L_{10}			1994 Predicted L_{10} versus 1994 Do-Nothing L_{10}	
	Lower	Higher	Unchanged	Significantly Better**	Significantly Worse**
A	7	8	2	3	1
B, B-1	8	8	1	1	1
C	8	5	4	6	0

* Values in table represent the total number of zones (highway sections) affected.
** A significant change is an increase or decrease of more than 5 dBA.

In developing the values in Table 30, the dead-ending of Frost Street (Zone 7) under Line A was considered not to result in any noticeable reduction in noise levels, due to the proposed interchange at Congress Street.

6. Construction Noise

Although the construction phase of a highway project is of relatively short duration compared to its post-construction life span, construction equipment can produce significant noise impacts in some instances.

The noise produced on the site varies, depending on such factors as the phase of the construction and the type, quantity and location of the equipment employed during that phase. Additionally, the noise produced by a piece of equipment can vary considerably during the different phases of its individual work cycle.

Construction of the Westbrook Arterial will result in a short-term increase in noise levels on existing streets due to truck traffic transporting construction materials to the project.

Line A is the only alternate which is anticipated to require a significant quantity of ledge excavation, in particular in the vicinity of the interchange at Congress Street. Ledge excavation may be encountered on Line C between the Fore River and the airport runway. Use of rock drills could result in noise impacts to residences in the adjacent areas.

Each of the alternates could require the use of pile drivers for bridge construction. While this type of equipment is significantly noisy, the areas where it might be used are not near densely populated areas. A possible means of mitigating this impact, as well as that of ledge excavation, would be to restrict these aspects of the construction activity to daytime hours.

E. GEOLOGY-SOILS-GROUNDWATER

The principal geology and soils impacts that could result from construction of any of the alternates are erosion and sediment pollution. Groundwater is not an important resource in this area, and there are no widespread continuous aquifers to be affected. The patchy nature of the granular sediments capping the marine clays will confine any effects on groundwater to the immediate highway area.

In terms of soil erosion, the build alternate with the shortest length generally would have the least environmental impact. This statement must be qualified due to soil conditions or construction factors unique to a particular alinement. Three of the alternates, A, B, and B-1, are almost equal in length; the fourth line, C, is up to 27% longer.

Cut construction generally has a greater potential impact from erosion and sediment pollution than highway fill. Highway cuts tend to collect and concentrate runoff, thereby creating more high velocity, erosive streams. The highway engineer has more control over the grain-size and erodibility of the material involved in construction of embankments. He can contour the fill during construction for minimum erosion and control the size of the working face.

For comparison, the amount of cut and fill on both the north and south sides of the roadway was measured for each alternate. For further comparison, the amount of cut in each soil erodibility type was measured. By relating the amount of soil cut in each soil type to its erodibility factor, K, a relative erosion potential for cuts in each alinement was produced. Line B has the lowest erosion potential in cut sections and is used as the base for comparison.

The total lengths of embankment sections for each alternate were determined and also compared by lengths constructed on land or in water. Fill placed in water has a greater potential of causing turbidity and sediment pollution.

1. All Lines

The section common to each alternate runs from the Maine Turnpike easterly to the Portland Connector, including the intersection with the latter. This area includes about 12 acres, most of which by natural drainage is in the headwaters of the Fore River. This area contains moderately to highly erodible soils. During construction, erosion and sediment pollution controls contained in the Bureau of Highways standard contract specifications should minimize sedimentation problems in the water. The area surrounding the Portland Connector interchange is broad and well drained. Since at present there are no physical restrictions on development, an indirect impact of the highway project could be erosion and sediment pollution from subsequent development near the intersection.

Once the highway is constructed, the roadway drainage would be directed into the headwaters of the Fore River, minimizing the impact of accidental highway spills, road salting and increased runoff.

2. Line A

Line A is approximately 2.75 miles long. About 51% of this length would be constructed in cut sections which occur almost equally on the north and south sides of the roadway. Forty-nine percent of the length would be highway embankment; of this length, location fill on land and fill in water would be 40% and 60%, respectively. Forty-eight percent of the cut construction is on highly erodible soils. The remainder is on soils of moderate and low erodibility. The cut sections on Line A have an erosion potential 1.7 times that of Line B.

On the north side of Line A, a 20 to 40 foot cut would be required westerly of the relocated Congress Street. The entire cut and interchange area covers 17 acres. Most of this area, including the deepest portion of the cut, would be drained westward to the overflow stream from Capisic Pond just above its mouth in the salt marsh.

The depth of this cut section would make it a source of erosion and sediment impacts by exposing large cut slopes in excess of 90 feet in length. These larger slopes would erode at the rate of 2 to 3 inches per year until stabilized; this erosion would not be significant except that most of the sediment would be channeled into the stream from Capisic Pond and the salt marsh. It is likely that a rock cut would be required since bedrock is near the surface in this area. It is also likely that the interface between the underlying marine clays and the granular surface deposits will be exposed. Groundwater flow at the top of the bedrock or the marine clay deposits could cause a slope stability problem requiring a wider cut with flatter slopes. Consideration would be given to measures to reduce erosion and trap sediment before it reaches the stream. Early slope stabilization, sediment checks and settling basins would be important in this area. Part of the cut area would be drained directly south via an unnamed stream onto the mud flats of the Fore River. Erosion control measures would be installed as required to protect this drainage also. A smaller cut would occur just to the east of the Portland Connector intersection. A 10 to 30 foot cut is planned in the high ground north of the abandoned canal. Only 6 acres are involved, but these contain moderately to highly erodible soils. Groundwater perched on marine sediment may be encountered requiring wider cuts for slope stability. The drainage from this cut would discharge at four points. The cut could be graded so that the runoff and sediment load would be distributed equally to each discharge point. With early slope stabilization and sediment checks and basins as necessary, erosion and sediment impact from the cut would be minimal.

Most of the fill construction for Line A is located at the upstream end of the Fore River marsh. Construction in this area would involve the dredging of 5 to 8 feet of muck prior to placing a low embankment, and would also involve a short relocation of the Fore River channel. Dredging and channel relocation in the soft organic clay and peat would release fine sediments and organic material into the salt marsh. Construction of the embankment would add turbidity to the river. Impacts from these activities could be minimized by using selected construction techniques. Dredging for muck excavation and channel

relocation would be scheduled during periods of tidal activity which would minimize sediment transport which is potentially damaging. Borrow material placed below the waterline would be coarse enough to minimize sediment production during embankment construction. After construction, steps such as placing riprap and landscaping will be taken immediately to minimize erosion from the embankment.

The collection and diversion of surface drainage would be only a minor impact from Line A, except in the Congress Street area as already discussed. Generally, the runoff would be collected from a 500-foot or less length of highway before discharge into natural drainage channels. All runoff between the Portland Connector and the Portland Terminal rail line would be discharged into the abandoned canal salt marsh. Discharge would occur at five points with only minimum collection. Except for the additional runoff from pavement, the drainage of the area would not be heavily impacted.

3. Line B

Line B is approximately 2.8 miles long. Highway cuts would comprise 25% of this length. The south side of the right-of-way would have 10% more length of cut than the north side. Highly erodible soils cover 60% of the cut areas along the alinement; moderately erodible soils cover 40%. Line B has the lowest erosion potential from soil cuts, for a relative value of 1.0. Embankments would be required for 75% of the length of Line B; 70% of the fills would be placed in water.

The greatest potential impact from erosion and sedimentation on Line B would involve 1,800 feet of fill and 1,800 feet of channel relocation on the north side of the Fore River east of Congress Street. A 20-foot high embankment fill with 10-foot toe berms would be placed in the existing Fore River channel. A new channel, 5 feet deep, would be dredged 200 feet to the south through the mud flats. Tests performed on boring samples indicate that as much as 50% of the organic clay which could be placed in suspension by dredging disturbance could still be in suspension after 6 hours in still water. During a 6-hour period the Fore River experiences one cycle of maximum velocity. Thus some percentage greater than 50% of the disturbed fine soils would be available for sediment transport. To keep turbidity and sedimentation to a minimum, it would be essential to use the least disturbing methods of muck removal. Dredging methods and timing would be controlled to limit sedimentation. The embankment fill would be another source of sediment pollution. The fill will be gradually worked out from the banks onto the wetlands. To further minimize erosion and sedimentation, coarse granular fill would be used below mean high water. Immediate steps such as placing riprap and landscaping will be taken to keep the fill from eroding.

Another fill with major erosion potential would be at the Congress Street-Line B interchange. This fill would cover about 11 acres, much of which is in or very near salt marsh. Except for the discharge of drainage collected within the interchange itself, there is no drainage collection or channeling in this area. However, the potential erosion from 11 acres of stripped land and the

equal area of new embankment would make quick construction and slope stabilization essential.

The portion of Line B west of Congress Street and east of the Portland Connector could have a significant impact on the area. The effects of erosion, sedimentation, and drainage changes would be confined to a very narrow corridor. The design of Line B would eliminate a 1,600-foot length of salt marsh in the abandoned canal area immediately south of the Fore River. By use of a narrow ditch and culverts, the marsh west of this area would be allowed continued connection with salt water. The topography and drainage design along the right-of-way would collect the runoff from 6,200 feet of highway. After several diversions through short sections of remaining marsh, all the drainage would be directed into the connecting ditch. The ditch would run eastward between the Portland Terminal rail line and the highway embankment, and discharge into the Fore River just south of the Fore River rail line bridge.

Construction along this portion of Line B would involve a 2,400-foot length of cut on the south side and a 1000-foot length on the north. The remaining length is embankment fill. During construction, the short sections of marsh in the drainage path would act as sediment basins and collect sediment, which would decrease their productivity. Any sediment not trapped in the marsh would be carried by the connecting ditch directly to the Fore River. To minimize the potential siltation, sediment checks or basins would be installed, as necessary, at the discharge points for each cut. Slope stabilization, including careful grading and seeding of all cut slopes and embankments would take place as soon as possible. A long-term and continuing impact after slope stabilization would be the increase in peak stream flow. The collected drainage from a long section of highway and increased runoff could scour some of the salt marsh in the drainage path.

At the east end of Line B a high fill, 1,600 feet long, with several toe berms would be constructed. The entire fill area would be drained into the salt marsh immediately west of Thompson's Point. As with other fills, there is a potential impact from erosion during the grubbing of topsoil and placing of fill. The area affected would cover 14 acres. Sediment checks would be used as necessary at the base of the fills. To aid in sediment collection the tops of the toe berms could be sloped toward the next higher fill.

4. Line B-1

Line B-1 is also approximately 2.8 miles long. Highway cuts would comprise 44% of this length and 75% of the cut length would be on the south side of the roadway.

Eighty-two percent of the cut construction would be in highly erodible soil; the remainder in soils of low and moderate erodibility. The cut sections in Line B-1 have an erosion potential 1.5 times that of Line B. Highway fill would be required for 56% of the roadway length; 40% on land and 60% placed in water.

The proposed profile for Line B-1 would require a 3,500-foot length of cut construction on the south side of the roadway between the Portland Connector and the Fore River. The cut would range from 10 to 30 feet in depth and would be mostly in highly erodible soil. The north side of Line B-1 would be embankment fill at the edge of the old canal, except for a 700-foot length of cut just east of the Portland Connector. The roadway from this entire section would drain into the salt marsh and the abandoned canal. However, it would discharge into the marsh in a much less restricted manner than would Line B. The cuts would have four separate discharge points into the marsh and the fill section would not restrict the flow of the broad canal. The low velocity water in the salt marsh and canal channel would be very susceptible to siltation. During construction, sediment checks and basins would be used as needed at discharge points of cut drainage. The water perched on marine sediments could be intersected in the cut sections, causing slope stability problems and requiring flatter or benched slopes. Temporary berms and immediate seeding would be necessary on the fill slopes. Any portions of the fill placed in water would require coarse borrow to limit sedimentation. The increased runoff and drainage changes would not have the impacts as they would from Line B. Line B-1 would require less drainage collection and channeling. The four discharge points and the unrestricted canal marsh would provide a better opportunity for fresh water mixing. East of Congress Street, Line B-1 would require a relocation of the Fore River channel and a short fill embankment on the mud flats. The extent of work required would be much less than for Line B; only 900 feet of channel dredging and 600 feet of fill. However, the same erosion and sedimentation hazards would exist for this alinement. Fill will gradually be worked out from the bank onto the wetlands, with riprap and landscaping used to minimize erosion problems. Specifications for fill would require coarse material and immediate steps will be taken to stabilize it, thereby further minimizing erosion and sedimentation.

The Congress Street interchange would require a 10-acre fill in or near salt marsh. Except for the discharge of drainage from within the interchange itself, there is no drainage collection or channeling. However, the potential erosion from 10 acres of stripped land and the equal area of new embankment would make quick construction and slope stabilization essential.

At the eastern end of Line B-1 the roadway would be depressed, passing under the Portland Terminal rail line. About 1,300 feet on both sides of the roadway would be drained west toward the Fore River. The discharge would be into an unnamed stream which runs south to the mud flats of the Fore River. Most of this length would be highway cut in soils of low erodibility. The confined drainage would give this area the potential for significant erosion impact. Erosion and sedimentation control measures would minimize the impact. The cut areas might intersect the water table perched on marine clay, requiring benched or flattened slopes for stability.

5. Line C

Line C is approximately 3.5 miles long. Highway cuts would comprise 68% of this length, evenly divided between the north and south sides of the roadway.

Sixty-three percent of the cut construction would be in highly erodible soils; the remainder in soils of moderate to low erodibility. The cut sections on Line C have an erosion potential 3 times that of Line B. Highway fill would be required for 32% of the alinement with 80% on land and 20% placed in water at the Fore River crossing.

Most of the construction at the west end of Line C, between the Portland Connector and Westbrook Street, would be highway cut. This low profile results from the depression of Line C under Westbrook Street. The cuts would average 20 feet in depth and be in moderately to highly erodible soils. A 2,200-foot length of cut on the south and a 600-foot length on the north would drain into the upper end of the abandoned canal. The low gradient of the canal downstream from this point would make it susceptible to sedimentation. Erosion controls and sediment checks or basins would probably be required at the points of drainage discharge. Test boring information indicates that these cuts might intersect the water table on the marine clay. This could require benched slopes or wider cuts with flatter slopes to ensure stability.

Uphill from the Stroudwater River, toward Congress Street, a straight section of Line C would require a shallow cut. Both sides of the right-of-way are on highly erodible soils and drain to the river. The Stroudwater River is sensitive to turbidity both for ecological and aesthetic reasons. Early slope stabilization and sediment checks at the discharge points would limit the impact of sedimentation.

The interchange of Line C and Congress Street would require mostly cut construction. The road cuts would be shallow, but the total disturbed area would be 14 acres, on highly erodible soil. Drainage from the 14 acres would be collected and fed to an unnamed tributary to the Stroudwater River. Unprotected slopes, until stabilized, could erode in excess of 0.5 inches per year. A significant potential would exist for severe sedimentation in the tributary and the formation of a sediment plume in the Stroudwater River. Sediment traps of some kind would be necessary at each discharge point into the tributary. Immediate slope stabilization measures would be needed in the interchange area.

The entire length of Line C from Congress Street east to the Fore River would be in a highway cut. This would be the longest cut proposed of any of the alternates, and would cross soils of all erodibilities. A 3,200-foot length on the north side and a 1,600-foot length of cut on the south would drain onto the grass flats of the Fore River. As much as 2 inches could be eroded from cut slopes until stabilized. This erosion could produce significant amounts of sediment and affect the productivity of grasses in the Fore River. Sediment checks in the ditches and several intermediate sediment basins would be necessary to control sedimentation. The fresh water discharge from the ditches would mix with fresh water from the Stroudwater River, thereby having little environmental impact.

A major source of sediment pollution on Line C would be the fill operations necessary to build the approaches to the new Fore River bridge. The mechanisms

for potential sediment transport and sedimentation would be similar to those described in the dredge-and-fill portions of Line B. Controls on the fill methods, riprap, landscaping, and timing would help to eliminate the sediment available for transport. The use of coarse borrow material below mean high tide would minimize sediment pollution during filling operations.

Line C would interchange at Hobart Street for Congress Street again just north of the Fore River. Seventeen hundred feet of highway east of this interchange would be drained by a series of culverts and ditches back to the Fore River. This section would be in a series of cuts and fills on soils of low erodibility. The confined drainage would give this area the potential for significant erosion impact and would require erosion and sediment control measures to minimize the impact.

F. WATER

1. All Lines

The common section of the Westbrook Arterial from the Portland Connector to the Maine Turnpike is not expected to have any significant impact on the water resources of the study area.

2. Line A

The potential impacts of Line A on the water resources of the study area would occur as the line crosses the Fore River marshes west of Congress Street. These impacts involve possible eroded soils from the fill and cut slopes entering the watercourse. Once in the water, the heavier soil particles will immediately settle out of the water column while the very fine particles will remain suspended and be transported over varying distances before settling out of suspension. Turbidity is created by the suspended soil particles, and sedimentation occurs when the suspended particles settle out of the water column. Excess turbidity can cause a reduction in the photosynthetic process of aquatic plants, thereby reducing oxygen production. Sedimentation can cause changes in water depth which can result in increased temperatures which in turn reduces the capacity of the water to hold oxygen. High levels of suspended silt can also cause the mortality of gill-breathing organisms by coating the gills and interfering with respiration.

Where fill slopes abut wetland areas or watercourses, the stabilization of these fill slopes, using standard practices, such as placing riprap and landscaping, will be accomplished as soon as possible during construction to minimize the impact of erosion and subsequent turbidity and sedimentation.

Where Line A crosses watercourses, or fills them in, adequate structures or channel relocation procedures will be taken to prevent any reduction in water flow.

Based on the above procedures, the impact of Line A on existing water quality or quantity should be minimal.

3. Line B

The impact of Line B on water resources will occur primarily in the Fore River tidal wetlands and watercourses. As is the case with all lines, fill slopes abutting wetlands and watercourses will be stabilized during construction to minimize the impact of erosion, turbidity and sedimentation. Adequate structures will also be provided to maintain the tidal flow and prevent impedence of fresh water flows into the estuary. However, Line B does essentially eliminate the watercourse between the Portland Terminal rail line and the upland behind Stroudwater Road. A ditch of adequate depth and width will be provided between the edge of the fill slope and the railroad tracks to allow tidal flow to reach the remaining tidal wetlands in the upper reaches of this area while providing for fresh water drainage into the Fore River.

The structure for the Fore River channel to the west of Congress Street will be of sufficient width so as to allow adequate tidal exchange above and below the structure.

As Line B moves to the east and into the main Fore River channel area, it requires fill to be placed in the existing channel for a distance of 1,700 feet. This channel will be relocated into the tidal flats approximately 50 feet away from the toe of the filled slope. Steps to minimize turbidity caused by the excavation can be taken. Excavation, for example, could be performed during low tide periods, allowing the disturbed muds to settle out of the water in the excavated channel before coming in contact with higher tidal waters. Any interference with tidal movement in the existing tidal channel will be minimized until the new channel is ready to replace it. Should construction procedures which may cause excessive turbidity be avoided during early April and May or mid-August through mid-October, interference with phytoplankton blooms or anadromous fish migration will be minimized.

The excavation process for the new channel of the Fore River will disturb the mud sediments which contain heavy metals that seem to have accumulated over time from the sewage outfall located in this vicinity. The potential impact of this disturbance is discussed separately under section 7., beginning on page 166.

4. Line B-1

As was the case with Lines A and B, Line B-1 fill slopes in wetland areas will be stabilized during construction to minimize erosion and the attendant turbidity and sedimentation.

The channel relocation procedures described under Line B will be followed for Line B-1, and a discussion of sediment disturbance in relation to heavy metals is included for both alinements at the end of this section. However, Line B-1 is judged to have a lesser impact on water resources than Line B simply because there is less involvement with filling and dredging wetland areas. The impact of Line B-1 on the quality and quantity of water resources in the Fore River is not considered significant.

5. Line C

Line C also has the potential impacts associated with the placement of large quantities of fill in water areas. In this light, all steps to minimize the impacts that were previously described for the other lines will be used in the construction of Line C.

The waterway opening under the Fore River bridge structure will have a minimum base width of approximately 90 feet, which is considered adequate to prevent any significant interference with tidal water flow. Although there will be increased water velocities in this portion of the channel, these velocities should rapidly dissipate on either side of the structure because of the wide

expanse of tidal flats over which the water will flow after passing through the bridge opening.

Line C crosses two areas of fresh water between Congress Street and the westerly crossing of Westbrook Street. One area is at the interchange planned in the vicinity of Congress Street and Johnson Street. The construction of this interchange involves crossing the drainage pattern of some intermittent streams at right angles. These streams feed into a larger unnamed stream which in turn feeds into the Stroudwater River. The upper reaches of this unnamed stream are also filled by the construction process for the interchange. The drainage of water from these streams is piped in a manner which will direct the water into the first unnamed stream beyond the limits of grading for the highway. These small, shallow streams are quite susceptible to the impacts associated with erosion, sedimentation and turbidity. It is quite possible that even moderate amounts of sedimentation and turbidity could have the effect of destroying the aquatic habitat in this area as well as adversely affecting water quality in terms of temperature and dissolved oxygen. For these reasons, sedimentation basins should be constructed to contain the sediment prior to the drainage water entering the stream. This action, along with slope stabilization during construction, should minimize the impact on these streams.

As a result of the construction of abutments and retaining walls for the bridge over the Stroudwater River and the slope stabilization procedures used in the fill area, and because there will be no filling within the actual waterway of the Stroudwater River, there should be minimal impact on this water body as a result of this crossing.

Considering the actions which will be taken to minimize impacts during and after construction, Line C will have minor, short-term adverse effects on the water resources of the study area.

6. Deicing Compounds and Accidental Spillage of Toxic Materials

With the exception of Line C and the northerly portions of Lines A, B and B-1 from the Portland Connector to the Maine Turnpike, all alternatives east of the Maine Turnpike direct surface water drainage into the tidal wetlands of the Fore River. Sodium chloride contained in the highway runoff should have little adverse impact on these areas which are presently adapted to inundation with highly saline waters on a daily basis.

The majority of Line C drainage is also directed into tidal areas; however, drainage between the Congress Street interchange and the westerly crossing of Westbrook Street is directed into either the unnamed stream that feeds the Stroudwater River or the Stroudwater River itself. The unnamed stream will receive road runoff from approximately 1,400 feet of the roadway while the Stroudwater River will receive runoff from approximately 1,800 feet of roadway. Water samples taken above the Stroudwater dam in January of 1974 indicate very low levels of sodium chloride in this river. The State of Maine, as well as the City of Portland, had applied road deicing chemicals, as needed, since the late fall to both State and local roads. Much of the runoff from these roads

finds its way into the Stroudwater River through either natural or man-made drainage routes. For two days prior to sampling, the weather conditions consisted of intermittent snow and freezing rain and deicing chemicals were in use. The low sodium chloride level in the Stroudwater River above the dam indicates very high dilution ratio for the deicing chemicals that presently drain into this fresh water body. The additional drainage, containing deicing compounds, from Line C would have no significant adverse impact on the Stroudwater River water quality in this regard.

The introduction of drainage containing deicing compounds into the unnamed stream which feeds the Stroudwater River would cause an increase in salinity levels in this water body. This stream exhibits a short course and a relatively steep gradient which should help to reduce the exposure time of aquatic organisims to these increased salinity levels. These waters also presently receive some drainage from Congress Street which means that the organisms are presently subjected to some increased saline content during winter months. The addition of 1,400 feet of drainage to this stream will increase this exposure; however, the impact on aquatic organisms is considered insignificant.

The upper reaches of the Fore River, east and west of the Maine Turnpike, will also be subjected to increased highway drainage, containing road salts, from the Westbrook Arterial. This stream presently receives drainage containing road salt from the Maine Turnpike and the developed areas to the northeast through which it must pass on its way to the Fore River tidal marshes. This increased level of salinity over a relatively short time frame will have an insignificant impact on the aquatic life in this fresh water environment.

As a result of accidents on the proposed Westbrook Arterial, oil, gasoline and other toxic substances may be spilled into the water bodies of the study area. To minimize potential damage caused by these spills in water areas, guard rails will help to prevent the vehicle from leaving the road shoulder in areas where there would otherwise be the possibility of rupturing containers transporting toxins or petrochemicals.

7. Heavy Metals

Lines B and B-1 involve a large amount of channel excavation in the tidal flats of the Fore River to the east of Congress Street. Sampling indicated that mud sediments of these tidal flats contain the heavy metals of mercury, lead and zinc. The question arises as to what the impact will be on the water quality of the Fore River if these metals are disturbed during construction. In an attempt to determine if the distrubed sediment would release into solution any of the heavy metal constituents, "shaker tests" were conducted on portions of the 10-foot core samples from sediment sampling stations 1, 5 and 9 (Figure 24 on page 89). This shaker test involves the dilution of one part of sediment sample in four parts of preanalyzed ambient water. This mixture is then shaken vigorously for a specified time period and then filtered. The resultant water is then analyzed for heavy metal contamination.

The results of the shaker tests indicated that the release of heavy metals from the sediments was very low. However, there would be momentary violations of the Proposed Criteria For Water Quality set forth by the U.S. Environmental Protection Agency in 1973. These proposed standards permit no intentional addition of mercury to marine or estuarine waters with concentrations of mercury in excess of 1.0 ug/l unacceptable. Concentrations in excess of 0.05 mg/l of lead and 0.1 mg/l of zinc are also unacceptable using these criteria.

Upon disturbance of the Fore River sediments during the dredging process, it is possible that momentary violations could occur in the immediate vicinity of the construction site. However, it is felt that the dredging process is not as severe in disturbing sediments as is the shaker test; in this sense, release potential is lower. It is also felt that the dilution of the low levels of metals released will be so high that no violation will occur beyond the immediate construction site. Because of these considerations the violation of water quality is not considered significant. The availability of disturbed heavy metals to marine organisms as a result of disturbance is also considered not significant due to the dilution and extremely low levels that would result from this process.

G. VEGETATION

The following tables indicate the amounts of vegetative displacements that will result with each alternate under consideration. The tables will be referred to in the following discussion of the impacts of the proposed alternatives on the various vegetative communities within the study area.

Table 31

TOTAL VEGETATIVE DISPLACEMENT BETWEEN I-95 AND I-295
(Excluding Tidal Flats and Watercourse)

Alternative	Acres	% of Total 935 Acres
Line A	60	6
Line B	69	7
Line B-1	58	6
Line C	85	9

Table 32

DISPLACEMENT OF UPLAND VEGETATION

Vegetative Community	Total Acres in Study Area	Common Displacements Portland Connector to I-95	Total Upland Vegetative Displacements acres (% of total) A	B	B-1	C
Hardwood-White Pine	403	10	27(7%)	30(7%)	31(8%)	30(7%)
Open Area	322	1	14(4%)	4(1%)	6(2%)	38(12%)
Shrubland	53	5	8(15%)	7(13%)	8(15%)	11(21%)
Low Shrub-Bottom Woodland	20	--	-----	-----	-----	2(10%)
White Pine	3	--	-----	-----	-----	0.1(3%)
Hemlock-Hardwood	2	1	1(50%)	1(50%)	1(50%)	1(50%)
Totals	803	17	50(6%)	42(5%)	46(6%)	82(10%)

Table 33

DISPLACEMENT OF WETLANDS VEGETATION, TIDAL FLATS AND WATERCOURSE*

Vegetative Community	Total Acres in Study Area	Total Displacements acres (% of total) A	B	B-1	C
Regularly Flooded Saltmarsh	56	3(5%)	9(16%)	5(9%)	3(5%)
Coastal Saltmeadow	76	8(11%)	19(25%)	8(11%)	1(1%)
Tidal Flats	142	-----	8(6%)	3(2%)	7(5%)
Watercourse	46	1(2%)	7(15%)	2(4%)	-----
Totals	320	12(4%)	43(13%)	18(6%)	11(4%)

* Watercourse displacements will be replaced with structure to allow for water flows.

1. All Lines

A common point of intersection for all lines comes in the area of the Portland Connector. At this point, and moving west from it to the Westbrook Connector, all alternatives share a common path. In this sense the impacts on vegetation are considered to be the same and will be discussed in that light.

The most obvious and significant impact to vegetation in this area is the direct elimination of vegetation within the limits of grading for the Arterial. This common portion of the line passes through four vegetative associations from the Portland Connector to the Maine Turnpike. Table 32 delineates the vegetative losses which will occur as a result of this common portion of the Westbrook Arterial. Although these losses do reduce the total acreages available in the various vegetative communities, these losses are not considered significant to total vegetative diversity within the study site. The line does eliminate a major portion of one of two small stands of the hemlock-hardwood community on the study site, however this is not considered a significant vegetative resource since hemlocks are generously interspersed within the hardwood-white pine community.

The Arterial does, however, cross two small, intermittent streams west of the Maine Turnpike. These streams serve to drain extensive open areas in this vicinity and feed into the headwaters of the Fore River which has both low shrub and cattails associated with it, as well as various other fresh water aquatic plants. Standard procedures for erosion control should stabilize the fill slopes of the Arterial in this area. If not controlled, significant erosion and the resultant sedimentation in these intermittent streams and in

the shallow headwaters of the Fore River would result in the destruction of the existing aquatic vegetation through both a smothering process and a reduction or elimination of the photosynthetic zone due to turbidity.

2. Line A

When upland vegetation alone is considered under this alternative the 7% loss (Table 32) figure for hardwood-white pine and the 4% loss of open area are not considered significant to the vegetative diversity or distribution of the study area. However, the loss which occurs in the shrubland community rises to 15%. This total loss in the shrubland community does contribute to a reduction in vegetative diversity for the study area. Although this community comprises only 53 acres in the study area, it is arranged in a linear fashion throughout the utility rights-of-way and therefore provides important edge, food and cover for wildlife as well as walking and riding trails for people. This loss of diversity will be partially offset by the relocation and subsequent clearing of utility rights-of-way as well as by the planting of suitable vegetative species along the Westbrook Arterial right-of-way lines. This landscaping will be aesthetically pleasing and could be composed of species which would add to vegetative diversity as well as provide food and cover for wildlife.

The large stand of hardwood-white pine to the west of the upper reaches of the Fore River tidal marshes is essentially cut in half, from east to west, by Line A. This has further potential impact on the vegetation in two ways.

First, the construction practice involved will require a series of cuts through the existing topography. Where these cuts are severe, and the groundwater level is high (i.e., within 10 feet of the surface), they will have a tendency to lower the groundwater table, to some degree, along the upper portions of the cut slopes. If this lowering occurs, the vegetation growing in this area which is dependent upon the groundwater level to maintain its moisture supply could be adversely affected. This impact would apply more to vegetative species such as the oaks which rely on a tap root system for water supply, than it would to species such as the white pine or shrubs which rely on a more shallow rooting system.

The second impact related to this clearing and cutting process revolves around the opening up, in an east-west direction, of the more sheltered, central portions of this stand to greater wind velocities. Individual trees which were previously in the more protected middle portions of the stand now are placed on the edge and as a result are more exposed to the effects of the prevailing north and northwest winds in the winter and south and southwest winds in spring and summer. This added exposure to wind tends to increase the evapotranspiration rate around the leaves of these trees and as a result the water demand goes up. This increased water demand, in combination with potential lowering of the groundwater table--thereby reducing some available water to the root system--could lead to increased dessication, wilting and loss of vitality for some individuals. This process, when combined with the potential for weakening root systems during construction and increasing area for wind stress, creates conditions which are favorable to "blow downs" and mortality along the newly opened road. Due to the species composition, soil

conditions, and grading of slopes along the cuts, the number of individuals lost in this fashion is not considered significant. However, care should be taken to remove any trees which show signs of being sufficiently weakened by this new exposure to the extent that they may fall.

The significant vegetative impact as a result of Line A takes place in the Fore River wetlands. The direct displacements take place in the upper reaches of the Fore River marshes. In this vicinity, Line A displaces 3 acres of the saltmarsh and 8 acres of the saltmeadow communities. This represents a loss of 14% of the 22 acres of saltmarsh and 59 acres of the saltmeadow stands west of Congress Street. (Figures 39 and 40 on pages 176 and 177.)

Since these saltmarsh and saltmeadow grasses produce the vegetable matter for the food web in the estuary, there will be a direct reduction in productivity as a result of these losses.

For the saltmarsh stand, the production will be reduced by approximately 12 tons per year and for the saltmeadow the loss will approach 80 tons. The impact of these losses will not only adversely affect the estuarine food web but that of Casco Bay as well.

The percentage loss of production in the Fore River is directly related to the number of acres lost and is 5% for the saltmarsh community and 11% for the saltmeadow community. The total productive capacity for the estuary would be reduced by approximately 9% from these standing crops if Line A were constructed.

A further potential impact to the tidal wetlands is the erosion of material from the fill slopes, where they pass through or abut these wetland areas. Line A has 1,700 feet of fill slope on its northerly side and 3,600 feet on its southerly side, which fall into this area of concern. The erosion and subsequent sedimentation and smothering of these adjacent stands of grasses could result in significant amounts of additional acreage being lost to production. It is of paramount importance that these fill slopes be stabilized as soon as practicable during construction to minimize this problem.

3. Line B

The impact of Line B upon the vegetative communities west of the Fore River marshes should be considered similar to those discussed previously under Line A. The institution of the standard procedures to minimize these impacts under Line A are also considered applicable to Line B in this portion of the study area.

The impact of Line B is the most severe on the tidal wetlands. This line eliminates as much productive marsh grass community as all other lines combined. This displacement occurs both east and west of Congress Street. To the west of Congress Street, Line B displaces approximately 6 acres of saltmarsh and 11 acres of saltmeadow, which means 27% and 19% losses, respectively, for each vegetative community in this vicinity. To the east of Congress Street, a displacement of 3 acres of saltmarsh occurs which reduces the 34 acres in this

area by 9%. The loss of 8 acres of saltmeadow in this area reduces the 17 acres in this area by 47%. (Figures 41 and 42 on pages 178 and 179.)

In terms of total displacement for these vegetative stands in the Fore River, the saltmarsh community would be reduced by 16% and the saltmeadow community by 25%. Thus, the production of vegetable matter for the food web would suffer a loss of approximately 37 tons per year or a 16% decline from the saltmarsh stand, while production from saltmeadow grasses would be down by 190 tons, or a 25% decline. When these losses are combined, the Fore River estuary has lost 23% of its productive capacity from the stands of saltmarsh and saltmeadow.

Line B will also have approximately 5,000 feet of fill slope abutting viable marsh grass communities and 2,000 feet of fill slope abutting tidal flats. These fill slopes are susceptible to erosion, which would result in subsequent sedimentation and smothering of the adjacent grasses and flats, further reducing the productive capacity of the Fore River. It is therefore essential that these slopes be stabilized as soon as possible during construction to minimize this occurrence.

Although Line B has its greatest impact on the Fore River wetlands, it also has a significant impact on the diversity and distribution of the vegetation located to the west of Thompson's Point. As the line emerges from the Fore River, it cuts diagonally across a steep hill and into the upper tidal marshes located west of Thompson's Point. Although the acreages of the vegetation lost as a result of this alinement may not be overly significant, the way in which the vegetation is intermixed gives it a diversity not found elsewhere in the study area. In this sense Line B, by eliminating the more westerly portions of this area, as well as by cutting through the steep hill adjacent to the marshes, eliminates much of the diverse nature of the area and has a significant impact in this unique portion of the study site.

4. Line B-1

The impacts of Line B-1 upon the vegetative groupings west of the tidal marshes will be similar to those of Lines A and B, the major difference being that Line B-1 displaces approximately 3 more acres of this community than does Line A. This increased loss occurs west of Congress Street where Line B-1 is cut into the side of the hill near Stroudwater Road. This cut extends west approximately 2,800 feet from the Fore River channel. The cut portion is made on the southerly side of the Arterial, while fill is placed on the northerly side adjacent to the marsh lands. From the easterly tip of this upland, Line B-1 cuts a path from 180 to 220 feet wide along the side of this hill. The first 1,400 feet of this cut displaces all of the hardwood-white pine community on this hill except for a narrow band 20-40 feet wide which will be left between the remaining developed areas on Stroudwater Road and the top of the cut slope. As Line B-1 moves westerly, it continues to cut along the side of the hill until it reaches the most westerly portion of the tidal marshes, crossing the power line right-of-way and moving into the central portion of the hardwood-white pine community. As Line B-1 cuts along the side of this hill, and displaces the band of hardwood-white pine in its path, it will expose the more

centrally located trees of this stand to the potential impacts discussed earlier for this community. These concerns would be especially valid for the narrow band of trees left between the line and the remaining developed areas of Stroudwater Road. Therefore, special care must be taken with construction and grading in this area.

A significant vegetative loss under Line B-1 occurs in the tidal marsh area. Direct displacement occurs both east and west of Congress Street. To the west of Congress Street, approximately 3 acres of saltmarsh community are lost along with approximately 4 acres of the saltmeadow community. This represents a loss of 14% of the productive saltmarsh stand and a 7% loss of the productive saltmeadow stand in this area. To the east of Congress Street, Line B-1 displaces approximately 2 acres of the 34 acres of saltmarsh and 4 acres of the 17 acres of saltmeadow, which results in 6% and 24% losses, respectively, for each community in this vicinity. (Figures 43 and 44 on pages 180 and 181.)

The total displacement of 5 acres of saltmarsh and 8 acres of saltmeadow reduce these communities in the Fore River by 9% and 11%, respectively.

Translated into terms of production for the food web, Line B-1 would reduce the amount of vegetable matter from the Fore River saltmarsh stand by approximately 20 tons per year or a 9% decrease. The decrease from the saltmeadow community would approximate 80 tons or an 11% loss.

When the losses for these two vegetative communities are combined it means that the Fore River estuary has lost approximately 10% of its productive capacity from these standing crop sources.

In addition to the direct displacement of viable tidal wetlands grasses, a further potential impact can be identified where fill slopes abut these grasses. Line B-1 has approximately 3,100 feet of such fill slope on its northerly side and 3,200 feet on the southerly side. To prevent the erosion of this fill and the subsequent sedimentation and smothering of the adjacent grasses, these slopes will be stabilized as soon as possible during construction to reduce further losses of acreage and production.

5. Line C

The 7% loss incurred under Line C for the hardwood-white pine community is similar to the amounts lost under Lines A and B; however, the secondary impact of wind on this vegetative type for Line C may be reduced. Since Line C moves in a northwest-southeast direction, the potential impact of the prevailing winds may not be as important in terms of creating stress on the individual trees at the top edge of the cut slope. This should serve to lessen the number of potential "blow downs" in relation to the other proposed lines.

A small corner of the pure white pine stand is lost under Line C. This represents 3% of this stand and is not considered significant to the vegetative community.

A 10% loss in the low shrub and bottom woodland along the Stroudwater River and its feeder stream is not considered significant, because it is contained in two relatively small, nonlinear, areas where the road bridges the Stroudwater River.

The loss of 21% of the shrubland under Line C constitutes the largest destruction of this group and can be said to reduce significantly both the diversity of the vegetation as a whole as well as impinging upon the viability of the individual community on the study site. This impact on the shrubland growth will be minimized when utility lines are relocated and landscaping completed.

The open area vegetation under Line C loses approximately 12% of the total 322 acres in the area. This loss occurs primarily on both sides of Congress Street between the Portland Jetport and the Stroudwater River. The majority of the open area in this vicinity reflects active or abandoned agricultural uses. The vegetative species are mostly herbaceous with some woody plants moving into the abandoned portions, following a natural successional pattern. These areas provide a variety of food and some cover for wildlife and are considered valuable in creating edge conditions. The impact of Line C on this community as a whole is not particularly significant in light of the fact that the abandoned agricultural areas, unless maintained, will continue in their successional growth and will no longer be considered open area but, more likely, shrubland and eventually hardwood-white pine. Also, the highway right-of-way may be planted with species which are similar to the ones lost during construction. Thirdly, if the abandoned agricultural areas eventually go into the housing market, the lawns and bushes planted as a result of landscaping would have a tendency to replace the natural successional growth and return the vegetative community to a similar open area type of herbaceous growth.

It is therefore reasonable to say that the loss of 12% of this group of plants is not significant in terms of the total or individual vegetative communities for either diversity or viability. However, Line C does divide this large area of open vegetation. This division may lead to further abandonment of presently maintained parts and thereby increase the likelihood that these areas will lose their open character through the successional process.

In terms of the losses of saltmarsh and saltmeadow, Line C has the least impact of any of the proposed alternatives. The 3 acres of saltmarsh community displaced as Line C crosses the Fore River represent 9% of the total community east of Congress Street while the 1 acre of displaced saltmeadow community amounts to 6% of the total in this area. (Figures 45 and 46 on pages 182 and 183.)

The 3 acres of saltmarsh and 1 acre of saltmeadow taken represent 5% and 1% of the total available acres of each community in the estuary.

The production of vegetable matter for detritus would be reduced by 12 tons per year from the saltmarsh stand and 10 tons from the standing crop of the saltmeadow community. The total productive capacity of the Fore River from these two vegetative stands will be reduced by 2% if Line C is constructed.

Line C does pass through the westerly portion of the largest single stand of saltmarsh community in the Fore River Estuary. The fill placed in this area will have approximately 880 feet of fill slope abutting this stand of saltmarsh grass. It is especially important to protect against erosion and sedimentation in this area to prevent further loss of productive growth from this vegetation. Exposed slopes of this fill material will be stabilized as soon as possible during the construction period.

Line C also displaces an area of tidal flats that represent 5% of the 142 total acres in the study area. This loss is not considered significant. However, because such a large fill is being placed in the tidal area, slope stabilization will be carried out as soon as feasible during construction to prevent erosion, sedimentation and further loss of tidal flats.

6. Deicing Compounds

The impact of road salt on the vegetation of the study area will vary with both the species type and the distance away from the source of the compounds.

The impact of sodium chloride on soils and vegetation has been well established by numerous studies in Maine (Hutchinson, 1967 and 1969). As runoff of sodium chloride occurs from the highway and is filtered through the soil, the positively charged sodium ions tend to be adsorbed onto the negatively charged soil particles while the negatively charged chloride ions may remain in the soil water or filter to the groundwater table. If excessive sodium ion concentrations are found in the soil they tend to affect physical properties such as drainage as well as create osmotic imbalance in plant tissues, when soil water is absorbed. This imbalance can lead to dessication of the plant tissues.

In the study area the Hardwood-White Pine, White Pine and Hemlock communities would seem to be quite susceptible to roadside damage from deicing chemicals because their species make-up is predominantly sugar maple, red oak, white pine and hemlock. Sugar maple is intolerant of sodium chloride, and white pine only slightly more tolerant; red oak is a tolerant species. Hemlock, an intolerant species, is also intermixed in this community as well as existing in pure stands quite close to the common section of all lines. Where the intolerant and moderately tolerant species of vegetation occur within the influence of the salt spray and runoff from the highway, damage can be expected to occur. This damage will be reduced by the provision of drainage ditches at the toes of slopes to guide runoff into the tidal areas of the study site, where the impact is negligible. At the same time, revegetation of exposed slopes could be undertaken with species of vegetation that are tolerant of sodium chloride.

The remaining vegetative communities in the study area will not be significantly adversely affected by road salting due to tolerance to, or limited contact with, the deicing compounds.

LEGEND

WATER CHANNEL

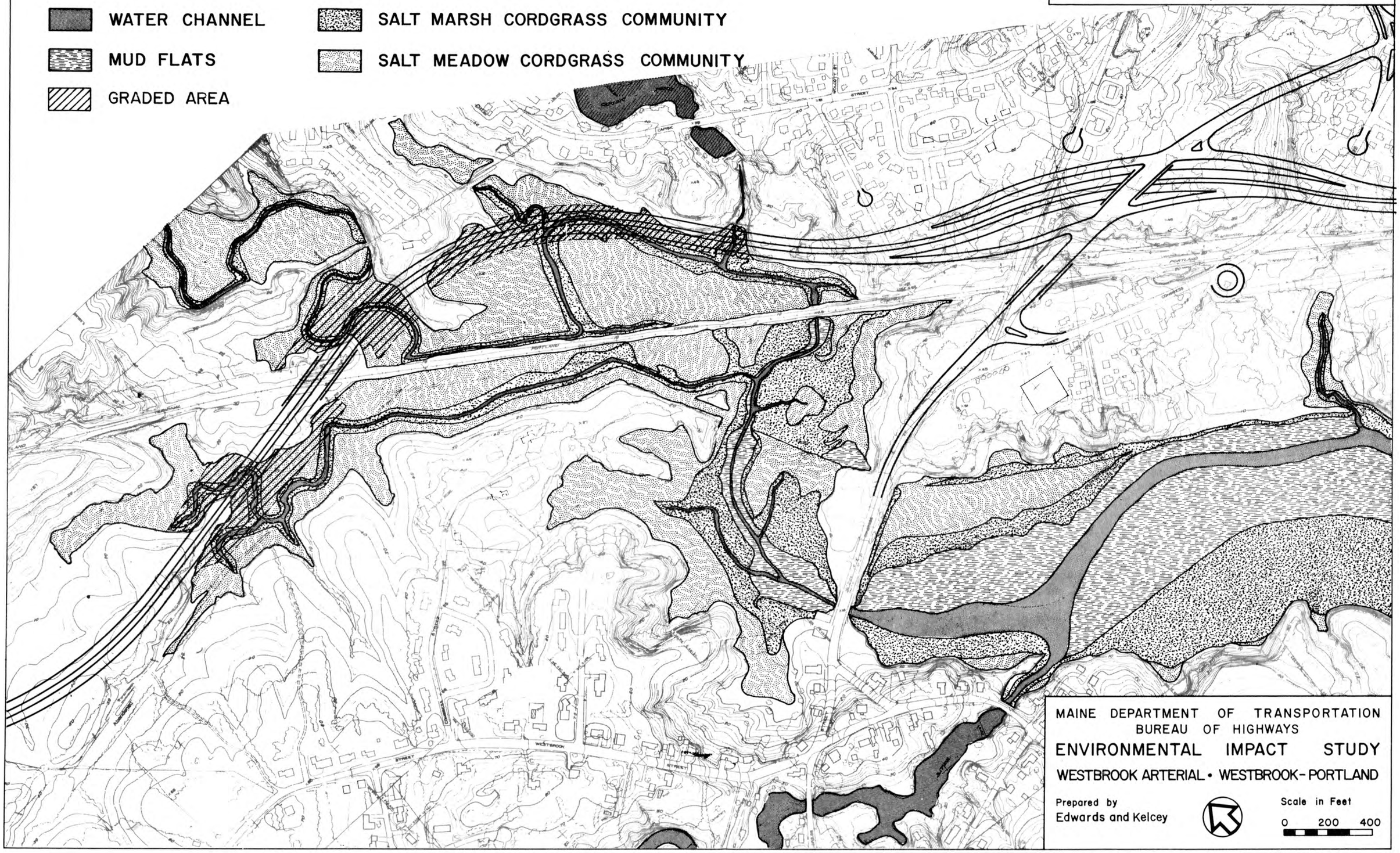
MUD FLATS

GRADED AREA

SALT MARSH CORDGRASS COMMUNITY

SALT MEADOW CORDGRASS COMMUNITY

LIMITS OF GRADING IN WETLANDS
LINE A



MAINE DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

ENVIRONMENTAL IMPACT STUDY

WESTBROOK ARTERIAL • WESTBROOK-PORTLAND

Prepared by
Edwards and Kelcey

Scale in Feet
0 200 400

FIGURE 39

LIMITS OF GRADING IN WETLANDS
LINE A

LEGEND

- WATER CHANNEL
- MUD FLATS
- SALT MARSH CORDGRASS COMMUNITY
- SALT MEADOW CORDGRASS COMMUNITY
- GRADED AREA

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Scale in Feet
0 200 400

FIGURE 40

LEGEND

WATER CHANNEL

MUD FLATS

GRADED AREA

SALT MARSH CORDGRASS COMMUNITY

SALT MEADOW CORDGRASS COMMUNITY

LIMITS OF GRADING IN WETLANDS
LINE B

CHANNEL
RELOCATION

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Scale in Feet
0 200 400

FIGURE 41

LIMITS OF GRADING IN WETLANDS
LINE B

LEGEND

WATER CHANNEL

MUD FLATS

SALT MARSH CORDGRASS COMMUNITY

SALT MEADOW CORDGRASS COMMUNITY

GRADED AREA

CHANNEL
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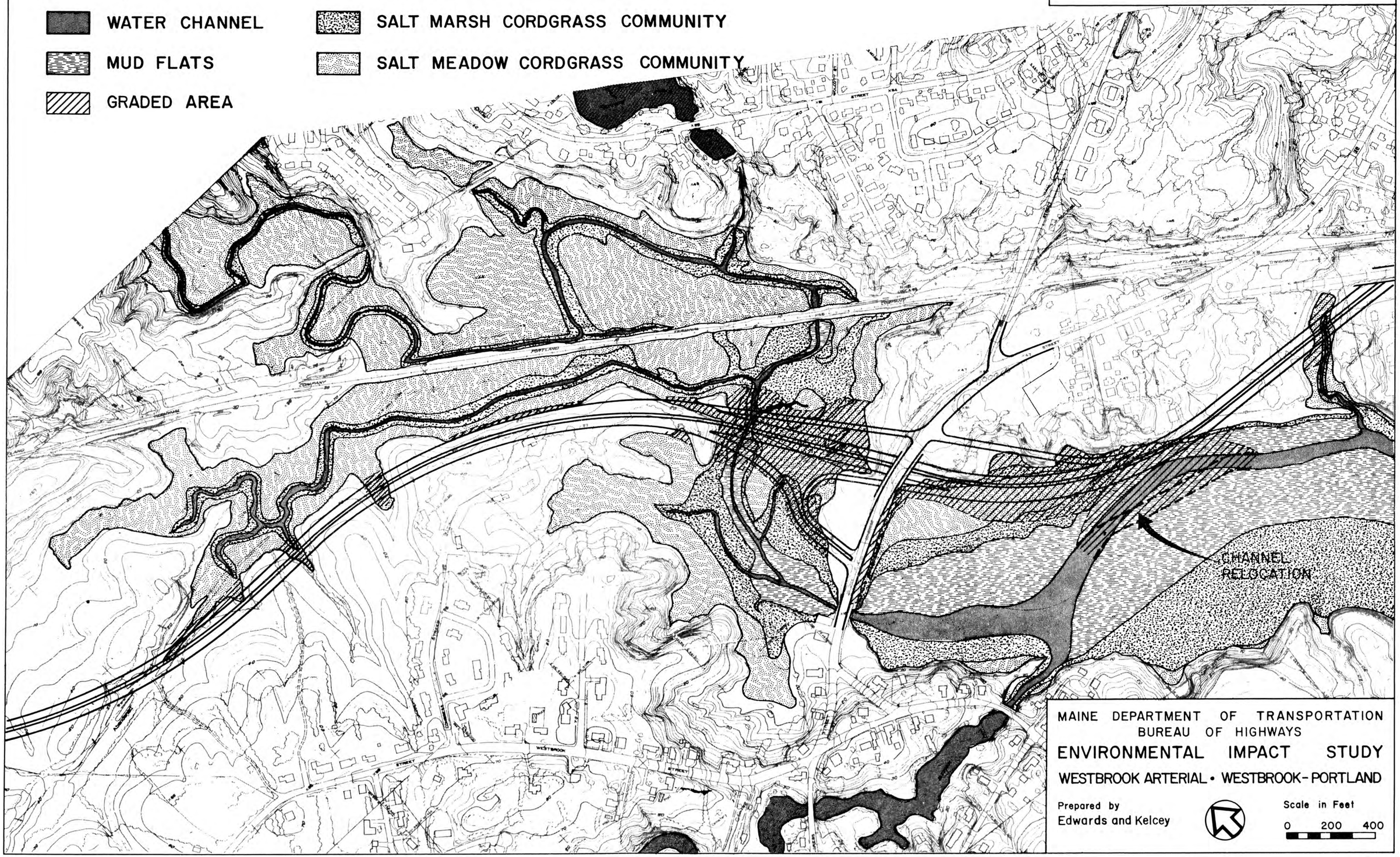
Scale in Feet
0 200 400

FIGURE 42

LIMITS OF GRADING IN WETLANDS
LINE B-I

LEGEND

- WATER CHANNEL
- MUD FLATS
- GRADED AREA
- SALT MARSH CORDGRASS COMMUNITY
- SALT MEADOW CORDGRASS COMMUNITY



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Scale in Feet
0 200 400

FIGURE 43

LIMITS OF GRADING IN WETLANDS
LINE B-I

LEGEND

WATER CHANNEL

MUD FLATS

SALT MARSH CORDGRASS COMMUNITY

SALT MEADOW CORDGRASS COMMUNITY

GRADED AREA

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Scale in Feet
0 200 400

FIGURE 44

LEGEND

WATER CHANNEL

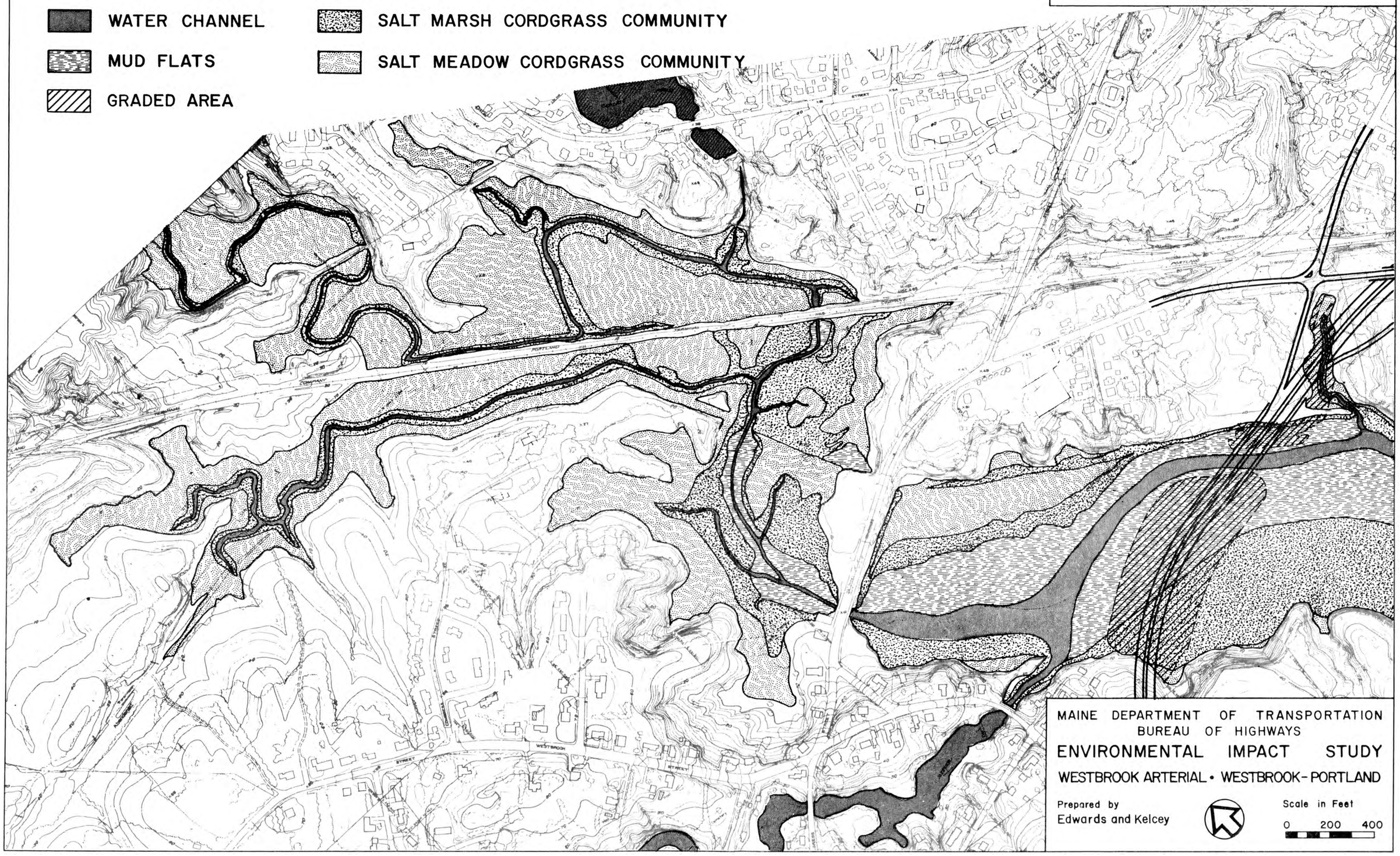
MUD FLATS

GRADED AREA

SALT MARSH CORDGRASS COMMUNITY

SALT MEADOW CORDGRASS COMMUNITY

LIMITS OF GRADING IN WETLANDS
LINE C



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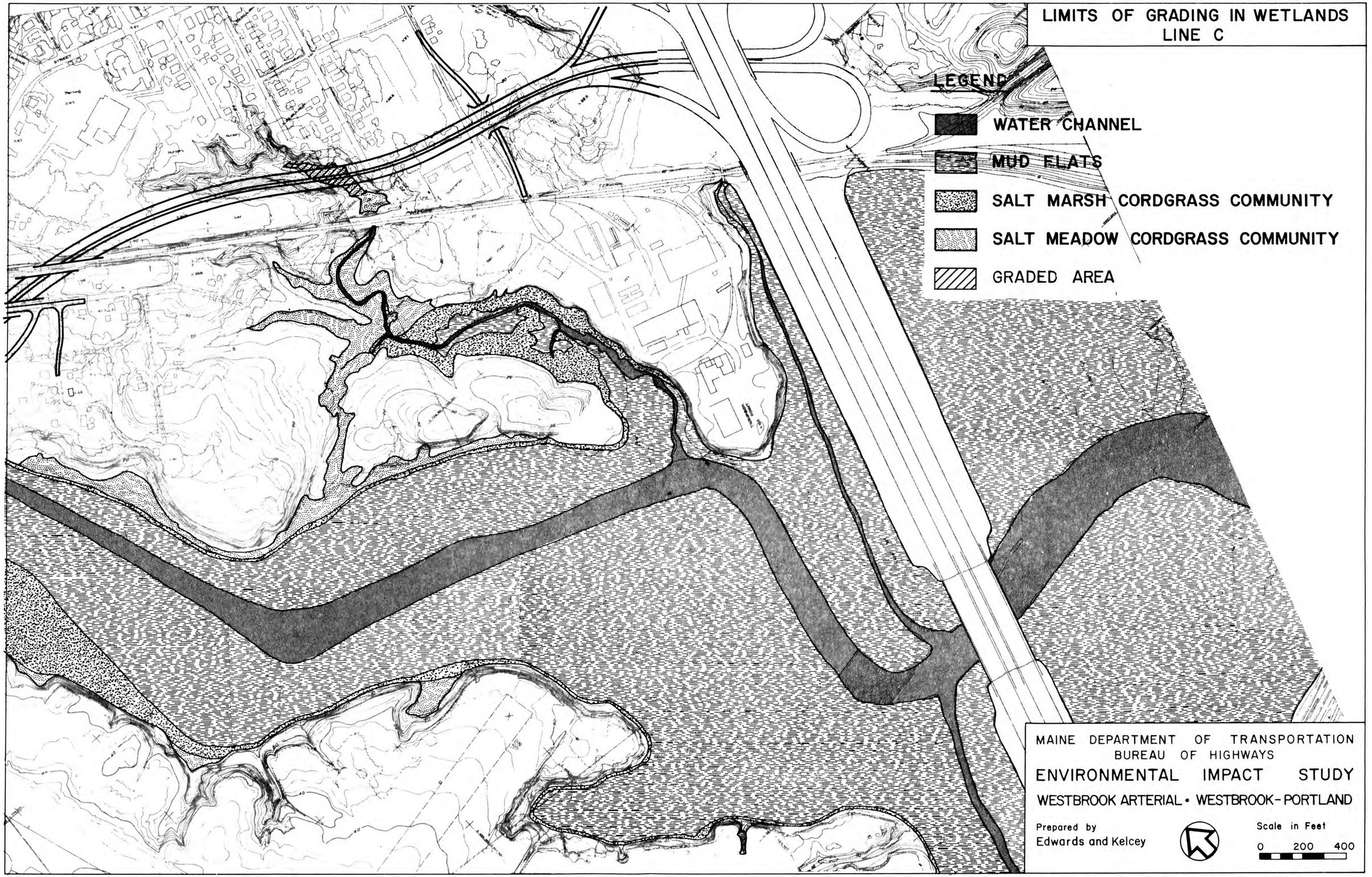
Scale in Feet
0 200 400

FIGURE 45


LIMITS OF GRADING IN WETLANDS
LINE C
LEGEND
WATER CHANNEL
MUD FLATS
SALT MARSH CORDGRASS COMMUNITY
SALT MEADOW CORDGRASS COMMUNITY
GRADED AREA
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Edwards and Kelcey
Scale in Feet
0 200 400

FIGURE 46

H. WILDLIFE

1. All Lines

The impact on wildlife of the common portion of the Westbrook Arterial alternatives, from the Portland Connector west to the Maine Turnpike, involves two important areas.

The first concern is the loss of shrubland along the utility rights-of-way. This habitat, which is distributed in a linear fashion, provides excellent food and cover for numerous wildlife species as well as edge areas which many species may use to traverse the study area. The proposed Arterial not only displaces the food and cover provided here, but it also disrupts the connective layout of these rights-ofway. This impact could be lessened by the relocation of the utilities with subsequent establishment of growth along new rights-of-way as well as possible provision of suitable plantings of food and cover species, in appropriate places, along the Arterial right-of-way line. However, the connective nature of these rights-of-way will be lost with the new roadway forming a barrier to the unrestricted movement of wildlife in a north-south direction. There will be an unavoidable loss of wildlife due to road kills as animals try to move across the Arterial in this vicinity. However, the installation of short, wide mesh fencing would have the tendency to move wildlife parallel to the roadway, unless crossing was of paramount importance to them, thereby minimizing the number of kills.

Although the area to the north of the common section of the Arterial west of the Portland Connector will be subject to fairly intensive development, the area does contain the upper reaches of the Fore River fresh water courses. This section of the Arterial separates these fresh water courses from the remainder of the study area. The fresh water area becomes isolated by the Portland Connector on the east, the Arterial on the south, the Maine Turnpike on the west and the Portland Terminal rail line and developed areas on the north. In this sense it would seem that potential use by wildlife will be quite limited.

2. Line A

The impacts of this alternative upon the wildlife resources of much of the study area are not considered serious. The easterly portion of Line A travels through developed land which is of marginal value to many wildlife species. The area north of the Portland Terminal rail line, between Congress Street, Frost Street and the Fore River tidal marshes, is generally wet with some cattail growth and does provide nesting, food and cover for some wildlife species. Line A parallels this area to the north; however, the relocation of Congress Street will bisect it and the simultaneous construction of these two portions of the project will create a major temporary disturbance of the area during this period.

As Line A moves further to the west it passes through the northerly portions of the wetlands above the Portland Terminal rail line. The construction of

this portion of the line involves the extensive filling of these wetlands. Culverts will also be necessary to accommodate the flow from Capisic Pond and, further west, to avoid restrictions of tidal movement in both the Fore River and an adjacent tidal creek. The relocation of approximately 600 feet of the Fore River channel will also be necessary in this area.

Where filling of wetlands occurs, slope stabilization procedures will be followed to minimize erosion and subsequent sedimentation and smothering of grasses, algae and sessile organisms in the vicinity.

Any work which involves the creation of significantly turbid conditions in the waters of the Fore River should be avoided during the spring and early fall in order to minimize impact on the phytoplankton blooms and anadromous fish (smelt, alewife and striped bass) migrations which occur during these critical periods.

In order to minimize erosion, turbidity and sedimentation, any channel relocation can be performed during low tide periods.

This portion of the Fore River tidal marshes is also used heavily by waterfowl for resting and feeding. During the construction period this area would be unavailable for this purpose, although the waterfowl would have a tendency to move to other areas still within the estuary.

A reduction of the tidal wetlands productivity and the resultant impact on the estuarine food web can be expected to lower the potential carrying capacity (the maximum biomass that a system is capable of supporting continuously) of the Fore River and is considered to be a significant adverse impact. This reduction in potential carrying capacity can be predicted to have its greatest impact on the wildlife species that are directly associated with the estuarine food web. This impact is considered to be less severe than that encountered under Lines B and B-1 due to less tidal wetlands involvement.

Line A also passes through two portions of the upper Fore River marshes that are considered waterfowl nesting habitat. However, since waterfowl nesting habits depend on factors such as density of nesting pairs/square mile, visibility of other nesting pairs and topography, as well as suitable nesting habitat, it is still reasonable to assume that nesting will take place in these areas. If construction in this vicinity takes place during the nesting period (April-May) there is the potential to disrupt this process; however, after construction there will be suitable habitat still available to support nesting in the upper marsh borders and fresh water areas. As a result of this continued nesting there may be some losses of ducklings due to road kills as these birds do have a tendency to be less wary of road hazards in attempting to reach open water and food.

The effect of Line A as a barrier to wildlife movement becomes important as it proceeds south of the Portland Terminal rail line and moves west towards the Maine Turnpike. Prior to this point the alinement of the road restricts movements between the developed areas and the estuary. These north-south movements are probably minimal. However, as the line moves south and west the potential for north-south movements increase and the probability of road kills

goes up. The fencing measures discussed in an earlier section would help to reduce these mortality rates.

There will be a loss of food and cover associated with the trees and understory of the hardwood-white pine community displaced by the Line A limits of grading and subsequent clearing of a portion of the right-of-way. These losses serve to reduce the potential carrying capacity of this area for wildlife. However, since the loss is small compared to the remaining stands of this type, this impact is not considered significant.

3. Line B

Line B has a considerable impact on the wildlife associated with the Fore River wetlands. By the destruction of 28 acres of marsh grasses and 8 acres of tidal flats, this alinement causes a significant reduction in the essential foundation of the food chain of the estuarine environment. The grasses, detritus and algae found here form the basic foods for many of the filter feeders (such as the blue mussel and soft shell clam), worms, insects, snails, and crabs that inhabit these marshes. Also, the decay of these grasses and algae provide nutrients for use by phytoplankton, which in turn are fed upon by zooplankton, which in turn are fed upon by small fish. These organisms are then fed upon by the larger fish, birds and mammals, and in turn are used by man. Line B not only lowers production but it also displaces the physical area which the wildlife inhabits. To the west of Congress Street, Line B displaces most of the marshland between the Portland Terminal Railroad tracks and the upland behind Stroudwater Road. This area is used heavily by waterfowl for feeding and resting while the more westerly portions, in the upland bordering the high marsh, as well as the fresh water areas, are used as nesting sites by these birds. The displaced tidal creek located here provides habitat and spawning areas for bait fish (mummicogs and sticklebacks) as well as other marine vertebrates and invertebrates.

As the line moves further east it displaces more saltmarsh and saltmeadow, while at the same time eliminating 7 acres of tidal flats in which are found the soft shell clam, quahog and marine worms. These tidal wetlands are also the source of snails and other invertebrates which occupy a very significant position in the diet of waterfowl and shorebirds, as well as some mammals and fish species. Still further to the east, Line B partially eliminates another waterfowl nesting area in the cove to the rear of Thompson's Point.

It has been estimated, by the Maine Department of Inland Fisheries and Game, that the Fore River marshes have the nesting site capacity which would allow for the production of 20-25 black ducks on an annual basis. This indicates a nesting capacity for about 4 nesting pairs of black ducks in the study area. Line B has the highest potential to disrupt nesting habitat. However, it is felt that there will still be enough suitable physical habitat remaining on the site to continue to support 4 nesting pairs. As Line B will retain enough suitable habitat in the nesting areas, the impact on the production of ducklings is considered minor.

Other potential impacts of Line B include the erosion and subsequent sedimentation from the fill slopes abutting tidal wetlands. This consideration is of prime importance when dealing with sessile organisms. These non-mobile organisms are susceptible to smothering by any significant amount of material eroded from unprotected slopes, and this is added reason for the stabilization of these slopes as soon as possible during construction. The disruption of tidal flats during the channel relocation process will create some unavoidable, downstream and upstream turbidity and sedimentation during construction. This can be minimized somewhat by constructing this relocation during low tide when there is little interference from flowing tidal waters.

To further minimize losses to the animal food chain and estuarine productivity, work which will involve the creation of significantly turbid conditions in the Fore River should be avoided during the spring and early fall in order to avoid interfering with phytoplankton blooms which may occur during these times. This measure will also minimize interference with the movement of any anadromous fish entering the Fore River during these times.

Line B also has the potential to act as a barrier to the unrestricted movement of wildlife in a north-south direction. While some habitat and ranges will be actually displaced by the line, others will be divided in some fashion by the roadway. The movement of animals in a northerly or southerly direction, across the Arterial, will result in some mortality. This impact is unavoidable when a road is located in an area where wildlife is found. The use of low, large mesh fencing would still allow access across the site, while at the same time serving to guide wildlife parallel to the roadway, if the need to cross was not paramount.

In summary, Line B has the most significant adverse impact upon the productive ecosystem of the Fore River estuary, resulting in a disruption of the existing food chain, loss of cover, displacement and division of range and a loss in the potential carrying capacity for wildlife in general. This impact will be felt more severely by those organisms associated with the aquatic-wetland environment.

4. Line B-1

The wildlife impacts associated with Line B-1 are similar in many respects to those incurred with Line B. The most striking difference is the reduction of impact on the Fore River wetlands. To the west of Congress Street Line B-1 is moved into the upland, thus allowing the existing wetlands to remain intact. Although this realinement reduces the amount of hardwood-white pine available for use by wildlife, these losses are not considered critical to the wildlife carrying capacity of the study area. The interchange at Congress Street also has a configuration which removes less wetlands than does Line B. East of Congress Street, Line B-1 requires much less channel relocation, and it also moves onto the upland into the more developed areas sooner than Line B. In addition, Line B-1 does not encroach on the tidal marsh area in the cover to the west of Thompson's Point. While in a comparative fashion, Line B-1 still has a significant adverse impact on the potential carrying capacity of the

tidal marsh ecosystem, it does reduce the wetlands and waterfowl nesting area impacts considerably over Line B.

Measures to control erosion and sedimentation along fill slopes in the wetlands areas will help to minimize further losses to sessile organisms as well as grasses and algae. Work which would create turbid conditions in the Fore River should be avoided during spring and early fall, to avoid impacting the phytoplankton blooms and anadromous fish migration into the area. The procedures for relocation of the portion of the Fore River required under Line B-1 will be the same as described for Line B.

The barrier effect of Line B-1 is similar to that of Line B and similar procedures will be followed to reduce this impact on wildlife movements and mortality.

5. Line C

The impact of Line C on the food chain in the estuarine environment is minimal in comparison to the other three alternatives. Under this line, 4 acres of productive marsh grasses are lost, with the remaining wetlands displacements involving 7 acres of tidal mud flats. Although these losses will reduce the potential carrying capacity of the estuary for wildlife, the impact on this ecosystem, while still significant, represents the least disruption of all the alternates in this sensitive area.

A major difference between Line C and the other lines is the introduction of large quantities of fill material over mud flats almost at right angles to tidal flow. Rip rap will be placed in such areas to minimize erosion problems. The upper fill slopes will be planted with suitable vegetation to minimize erosion. However, during construction the potential for erosion and sedimentation is high. The smothering of grasses, algae and sessile organisms which would result from the sedimentation increases the impact of the project on the food chain of the estuary. It also seems likely that turbidity will result during this filling process. Line C has a high potential for this type of impact.

Work below mean high tide which would create excessively turbid conditions in the estuary should not be performed during early spring or early fall, in order to minimize interference with phytoplankton blooms or anadromous fish migration.

Line C also calls for an interchange at Congress Street near Johnson Street. This interchange will displace portions of the intermittent streams that feed surface runoff to the Stroudwater River in this area. This construction will involve the loss of some low shrub and bottom woodland vegetation, as well as the potential for erosion and sedimentation of this shallow stream resulting in both the loss of fresh water aquatic habitat, as well as potential mortality of some aquatic life. To minimize this impact, settling basins could be placed in the Arterial drainage system prior to the drainage entrance into the stream. These basins could reduce the impact of sedimentation and turbidity to an insignificant level in this sensitive area.

Further to the northwest Line C crosses the Stroudwater River, which will again require a filling process in the low shrub bottom woodland vegetative cover. Fill slopes will again offer the potential for erosion and subsequent sedimentation into the river at this location. To minimize this impact the sideslopes will be stabilized by vegetation. As a result of the construction of abutments and retaining walls for the bridge over the Stroudwater River and the slope stabilization procedures used in the fill area, and because there will be no filling within the actual waterways of the Stroudwater River, there should be minimal impact on this water body as a result of this crossing.

In considering upland wildlife, Line C would seem to have a greater impact than the other three lines. Its looping configuration essentially divides diverse wildlife habitat in a north-south fashion, thereby inhibiting wildlife movement in an east-west direction. This line tends to isolate the Fore River wetlands from upland wildlife residing between it and the Maine Turnpike. Line C also displaces more upland wildlife habitat types, while at the same time having the potential to divide many more home ranges of upland species. This line would seem to increase the number of potential road kills, as animals seek to move from one cover type to another. As mentioned previously, wide mesh, low fencing will be installed and such fencing will minimize these losses. However, the necessity of upland wildlife to cross this alinement would seem to increase, because it divides many diverse types of habitat.

V. PROBABLE UNAVOIDABLE ADVERSE EFFECTS

The preceding two sections provided a detailed description of the probable environmental effects--beneficial and adverse--of the proposed action and of the several alternate locations. This section summarizes those probable adverse effects of the proposal that are deemed unavoidable even though, in some cases, steps may be taken to minimize harm.

Displacement of Families, Businesses and Farms

	Families	Businesses	Farms	Other
Line A	34	4	0	0
Line B	3	2	0	0
Line B-1	7	2	0	0
Line C	14	0	1	1

In accordance with Federal and State laws, all potential displacees would have to be satisfactorily relocated prior to actual construction. However, the physical displacement, versus the relocation process, must still be considered an unavoidable adverse impact.

Impact on Historic Features

Line B would displace 5,600 feet of the original site of the abandoned Cumberland and Oxford Canal line.

Line B-1 would displace 3,000 feet of the original site of the abandoned Canal line.

Line C would affect former Canal locks and displace the historic Fickett House.

Visual Impact

West of Congress Street

Lines A, B and B-1 introduce man-made features into natural areas adjacent to the Fore River.

Line C passes through the rural Stroudwater neighborhood.

East of Congress Street

Lines B and B-1 are constructed on north bank of the Fore River.

Line C requires a bridge crossing of the Fore River.

Impact on the Noise Environment

Alternate	Exceptions to FHWA Design Noise Levels (Category B land uses)	Increase over ambient levels which cannot be minimized readily (residences) "Some Impact"	"Significant Impact"
Line A	6	0	0
Line B	3	12	6
Line B-1	4	8	0
Line C	12	8	0

Short-Term Erosion, Turbidity and Sedimentation

Construction of the Arterial will result in erosion, turbidity and sedimentation during the construction period.

Each line varies in terms of total length, length of cut sections, erodibility of soils, length of fill sections, and fill placed in water. It is expected that the impacts will also vary, and that they will unavoidably occur.

Short-Term Reduction in Water Quality

Line A - minimal effect on Fore River marshes west of Congress Street. Minimal probability of turbidity and sedimentation compared to other lines.

Line B - channel excavation in tidal flats causing disturbance of mud sediments that contain heavy metals. Significant probability of high turbidity and sedimentation.

Line B-1 - similar to Line B, but much less effect.

Line C - large quantities of fill in water for construction of approaches to Fore River bridge crossing resulting in high probability of turbidity and sedimentation.

Displacement of Saltmarsh and Saltmeadow

The significant vegetative impacts are the direct displacement of saltmarsh and saltmeadow grasses in the Fore River wetlands. Significant indirect displacement of the grasses may also occur if the erosion controls used are not implemented in a rigorous fashion. Since these grasses produce the vegetable matter for the food web in the estuary, there will be a direct reduction in productivity as a result of these losses. The percentage loss of production in the Fore River estuary is directly related to the number of acres of grasses displaced.

	Saltmarsh		Saltmeadow		Estimated Reduction of Productivity--total estuary (%)
	Displacement (Acres)	Annual Loss of Productivity (tons)	Displacement (Acres)	Annual Loss of Productivity (tons)	
Line A	3	12	8	80	9
Line B	9	37	19	190	23
Line B-1	5	20	8	80	10
Line C	3	12	1	10	2

Reduction in Wildlife Habitat

Upland Wildlife

Line C has a much greater impact on upland wildlife than the other three lines. It would displace more upland wildlife habitat types, and would divide home ranges, thus limiting wildlife movement.

Aquatic-Wetland Wildlife

Line A reduces waterfowl nesting areas and will affect aquatic life by reduction in tidal wetlands productivity.

Line B, as a result of the greatest displacement of saltmarsh and saltmeadow grasses, has the greatest effect on aquatic-wetland wildlife.

Line B-1 has impacts similar to Line B, but has a lesser impact on estuarine productivity and waterfowl nesting area displacement.

Line C, while having the least severe impact on estuarine productivity, will still contribute to a loss of carrying capacity for the Fore River aquatic system.

VI. SHORT-TERM USE VS. LONG-TERM PRODUCTIVITY

The short-term uses of man's environment tend to be construction oriented impacts which include reduction of water quality in the Fore River; the taking of homes and businesses, which may result in a short-term reduction in the City of Portland tax base; temporary deterioration of air quality; and noise from construction equipment and activities. These uses do not affect the long-term productivity of man's environment.

Construction of the Westbrook Arterial will cause some impacts which can be considered long-term. The loss of upland vegetation and a general reduction of wildlife carrying capacity in the study area will occur. The most significant effect on the long-term productivity of the natural environment is the permanent loss of productive saltmarsh and saltmeadow vegetative communities, as well as the reduction of tidal mud flat acreage. The losses will have a significant, long-term impact on the food web and potential carrying capacity of the Fore River estuary and, to a lesser degree, Casco Bay.

Construction of a highway on new location will unavoidably result in a general increase in noise levels where the facility passes through undeveloped areas. The increased levels will exist for the life of the highway. On the other hand, there will be decreases on existing streets--especially Brighton Avenue, Westbrook Street and Congress Street--due to reduction of traffic.

While the adverse effects on man's environment must be recognized, consideration must be given also to the long-term social and economic benefits. The Westbrook Arterial will fulfill a long-recognized need for an east-west highway between downtown Portland and Westbrook-Gorham as well as areas further west. Relief of traffic congestion on Brighton Avenue and Westbrook Street is essential to maintain a viable highway system in the transportation corridor. Improvements in traffic service and safety represent long-term, area-wide benefits with respect to highway user costs and reduced accidents, injuries and fatalities.

Construction of the Arterial will have a significant long-term benefit on the revitalization of the Portland Peninsula. The Arterial will be an additional factor in ensuring the success of this continuing revitalization program which has long range benefits with respect to employment and the economic base in the Portland area. Industrial, commercial and residential growth, although infringing on the rural character of Stroudwater, should also result in the improvement of the long term economic base; furthermore, this growth is a stated goal of the City of Portland as outlined in the Land Development Plan.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment of resources involves the consignment of those resources in such a fashion as to initiate an event or chain of events that cannot be prevented from occurring.

An irretrievable commitment of resources involves the consignment of resources to an action in such a fashion as to ensure that those resources are no longer available for any other present or future use.

Careful study and analysis provides the basic input needed to evaluate each alternative objectively and permit a wise choice of a preferred course of action to ensure that the commitments of resources are minimized and are compatible with society's priorities for utilization of its resources.

The construction of the Westbrook Arterial will result in both the irreversible and irretrievable commitment of available resources. A significant example is the displacement of some of the productive saltmarsh and saltmeadow communities in the study area. The irretrievable commitment of this resource occurs when the actual physical displacement of these grasses occurs during construction operations. As a consequence of this action, an irreversible chain of events is set into motion that results in a loss of productivity in the Fore River, and to a lesser degree, in Casco Bay.

There will also be an irretrievable loss of a portion of upland vegetation and wildlife habitat.

It can be considered that an irretrievable commitment of construction material will also be made.

Future development in the rural Stroudwater area is primarily dependent on the installation of sewers. The construction of the Arterial, which will provide better access to downtown Portland from the study area, will be a contributing factor in the Stroudwater development. The irretrievable loss of open space in Stroudwater will result from the planned urbanization of the area.

Construction of the Arterial would also irretrievably impair the natural visual quality of the Fore River.

Depending upon which alternate is chosen, there could be the irretrievable loss of the remains of a portion of the Cumberland and Oxford Canal.

Remaining land areas can be considered as irretrievably committed to this action when they are physically within the right-of-way of the Arterial.

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