Boston Harbor Cleanup Project:

Human Activities and Residuals

by

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Boston Harbor has been an environmental hazard for many years. It receives the outfall of two antiquated sewage treatment plants on the sites of Deer and Nut Islands that are insufficient to process the volume of sewage from the 45 cities and communities that they service. It also recieves point source discharge from 110 combined storm water runoff pipes which release raw sewage into the inner harbor on a regular basis. Although the problem has existed for a long period of time with nothing being done about it, it has now come under federal jurisdiction under the revised Clean Water Act of 1972. An ongoing court case between the United States Environmental Protection Agency and the Boston Metropolitan District Comission has found the Commonwealth of Massachusetts legally responsible for cleaning up the harbor. A federal judge has designated a new advisory council, the Massachusetts Water Resources Authority, to proceed with the cleanup. Faced with this task, the WRA has several courses of action open to them. The WRA has recently been given a court order to go ahead with secondary treatment, a move that the MDC had hoped to avoid. The project, requiring construction of a new treatment plant, is expected to cost $1 billion to be split between the state and federal governments.

The choices of construction for the project have different implications for the environmental quality of the harbor system and surrounding communities. These different effects were addressed in a study for the EPA. Variables to be considered by the WRA exist on two different levels. They must consider the

treatment stage, both primary and secondary. This includes the impact of construction of the plant and how it will affect the local environment and adjacent communities with destruction of land, noise levels, and an increase in traffic to the area during construction. They must also take into account operating costs once the construction has been completed. This includes questions of how far and by what means the sewage must be transported to be processed at the plant. The second level of consideration is what means of disposal will be employed after treatment. The three most feasible options for this are incineration, composting, and ocean dumping. Incineration poses the problems of odor and adverse effects on air quality, disposal of the ash, which is a potential threat to ground water through toxic leachate, and the political problems associated with finding a site for incineration. Composting poses problems of odor, the marketability of composted sludge, and the high cost of transport. Finally, ocean dumping poses hazards to both air and water quality. There are also broadbased environmental organization objections to this form of disposal. The form of disposal to be used has much bearing in choosing the location of the treatment plant; thus, the two levels are closely interconnected in the overall plan of sewage treatment.

The recommended Plan:

This section will use some of the parameters mentioned above to discuss the different options considered by the EPA to eliminate the sewage problem in the metropolitan area. The EPA

decided to locate the secondary treatment plant on Deer Island, the site of one of the two existing plants, and to upgrade the existing plants to more adequately process the sewage until the new plant is ready.[1] This plan consists of the new secondary sewage treatment plant that will be built on Deer Island which will receive directly the untreated sewage flow from the north sector of the district. It will also receive the sewage from the south sector after it has received preliminary treatment at the upgraded Nut Island facility. After being filtered at Nut Island, the sludge will be transported to Deer Island by a pipeline-tunnel system under Boston Harbor.[2] The sludges from the two sectors will be kept separate, because they will have different concentrations of trace metals. Part of the sludge from the south sector will be composted, because it contains lower concentrations of metals and will be of higher quality for marketing. Direct landfilling and incineration will be used to dispose of the rest. Landfilling will be done adjacent to the Deer Island plant, requiring minimal transport costs. Ash disposal and composting will be done on Squantum Point.[3]

Residuals and other effects of the plan: The overall effect of this plan will be compliance with the Clean Water Act and the NPDES regulations on sewage treatment waste water discharge. To carry out the plan will require construction of

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[1]Greeley and Hansen and Environmental Assesment Council, inc., "Draft Environmental Impact Statement on the Upgrading of the Boston Metropolitan Area Sewage System," (1978, U.S. EPA,p.6.)

[2]Ibid., p. 22.

[3]Ibid.

new facilities and disposal of much more solid wasten than under the current system. The secondary treatment system will include the construction of 31 aeration tanks, 47 sedimentation tanks, and a chlorine contact basin on Deer Island. It will also require a landscaped embankment landfill on Squantum Point covering about 70 acres which they say could become a recreation area after it is covered.[4] (who?

Ligiud residuals: Secondary treatment will create chlorinated waste water which will empty into Boston Harbor. The concentrations of chlorine will supposedly fall below the recommended 10mg/l. This level should not harm marine organisms.[5] Chlorination released into surface waters can impair the taste of fish, and can create toxic chlorinated organics. There is also a potential threat to groundwater supplies from leachate from the landfilled solid waste.

Solid residuals: The main identifiable solid residuals are the dewatered sludge in raw, ash, or composted form and the material from dredging and construction. We have already discussed many of the drawbacks involved in disposing of this solid waste. Landfilling is the least expensive but requires transportation and runs possible risk of groundwater contamination. Composting can only be done on a limited scale and is unfeasible when the waste contains toxics; and incineration has adverse air quality effects. The dredging and construction materials pose a less serious problem and will be

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[4] Ibid., Pp. 30-31.

[5] Ibid., p. 32.

disposed of in designated aeas.

Gas residuals: The primary gas residual will be odor from the different phases of treatment and disposal. A less significant effect on air quality will be caused by the increased traffic load to Deer Island and to the disposal site on Squantum point. This will be caused by the construction equipment and the flow of construction workers to the work site in the early phase, and then later by trucks transporting the solid waste. For example, the report estimates 125 truck round trips per day bringing and removing sludge from Squantum Point. Using an emissions model called Compilation of Air Pollution Emission Factors, (USEPA, 1975) emissions factors for large diesel trucks were multiplied by the estimated 39,000 miles traveled annually during construction at Deer Island.[6] Similar compilations were made for the estimated 1.5 million annual miles for transporting sludge. These levels were not considered to be significant air quality degradents by this report.[7]

Noise residuals: The city of Boston's Noise Control Regulations were used as a guideline for acceptible noise levels.[8] There seem to be different categories of regulation for residential and commercial areas and for temporary construction noise. The majority of the noise produced at Nut and Deer Islands will be short term due to construction. The noise produced at Squantum Point from trucks transporting

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[6] Ibid., p. 34.

[7] Ibid.

[8] Ibid., p. 35.

materials will be on a long term basis, but the report claims that they will be within allowable limits.

Other adverse environmental quality effects: The construction and landfill stages of the plan will destroy some areas of natural habitat. The entire Deer Island will be used for sewage facilities. Squantum Point will lose 70 acres to the landfill. Also there is a small salt marsh adjacent to the disposal area that could face some alteration. The report claims that no valuable biota will be effected in this way.[9] Another significant impact to biota will be from the dredging for the sewage transport lines under Boston Harbor. Aproximately 80 acres of harbor bottom and its fauna will be directly lost to dredging. Even more will be affected by the sedimentation from the dredging.[10]

Another effect will be that the old Deer Island prison will have to be moved.[11] The construction and transprtation will put added stress on the roads and communities adjacent to the sites of develpment. For this reason, when the EPA designated Deer Island as the site of the new treatment plant, it also imposed restrictions on the flow of equipment, materials, chemicals, and workers to the site to limit impact on these communities.[12] The EPA called for moving the bulk of materials

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[9] Ibid., p. 36.

[10] Ibid., p. 37.

[11] Andrew Blake, "EPA endorses Deer Island Site" Boston

to Deer Island by barge and bussing the workers there to reduce traffic on the roads in East Boston.

Benefits of this plan: In order to meet NPDES permit requirements for waste water dischargers, secondary treatment is required. This plan will reduce BOD and suspended solids down to 30mg/l, within the permitted discharge limits, and it will remove 85% of the suspended solids.[13] This plan also has the benefit of eliminating extra transport costs and environmental impacts associated with transport of the treated material.

Effects on Natural Systems and Ambient Environmental Quality:

The main mechanism at work in destroying the productivity and useability of Boston Harbor is a chemical one. Aside from billions of gallons of raw sewage and wastewater released into the harbor, 3000 metric tons per year of hydrocarbons, a highly toxic substance, are being dumped into the system.[14] A Greenpeace Report (1985) claims that 1,900lbs./day of other toxics and trace metals are permitted to be discharged into the harbor.[15] These chemicals are killing off the natural populations of estuarine fauna and replacing them with

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[13] Op. Cit. Greeley and Hansen, Upgrading of the Boston Metropolitan Area Sewarate System, p. 24.

[14] Robert P. Eganhouse, "Organic Substances Discharged to Boston Harbor" abstract.

[15] Diane Dumanski, "Greenpeace Report Ties 10 Sources to 90% Harbor's Toxic Pollution", The Boston Glove, 16 October 1985, p. 24.

opportunistic species.[16] Before ~~you~~ one can look at the chemical and ecological effects of the sewer system, it is important to understand the physical processes at work in the harbor. The effect ~~that~~ of these residuals ~~have~~ on their surroundings depends on where they are transported by ~~these~~ currents and what receptors they come in contact with while in transport. This is why knowledge of the physical processes involved is very important. A model of this type should be able to answer the following questions: Where and at what rate is discharge accumulating? What are transport paths and distribution patterns of metals, i.e. by surface sediment, suspended sediment, or dissolved into solvent? Could concentrations in sediments be a source of metals after the primary sources are removed? What meteorologic and oceanographic processes are responsible for redistributing metal-rich sediment, and do any of these processes have adverse effects on living resources in the harbor?[17] In this way the one model identifies and incorporates all of the other mechanisms in action.

Anonotated references:

My primary source was the Draft Environmental Impact Statement on the Upgrading of the Boston Metropolitan Area Sewerage System, released by the EPA in 1978. This 3 volume

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[16]Eugene D. Gallagher and Judith P. Grassie, "The Successional Dynamics of Capitella Sibling Species in Boston Harbor Seciment" abstract.

[17]Micheal H. Bother and Micheal G. Fitzgerald, "Heavy Metals in Sediments of Boston Harbor" abstract.

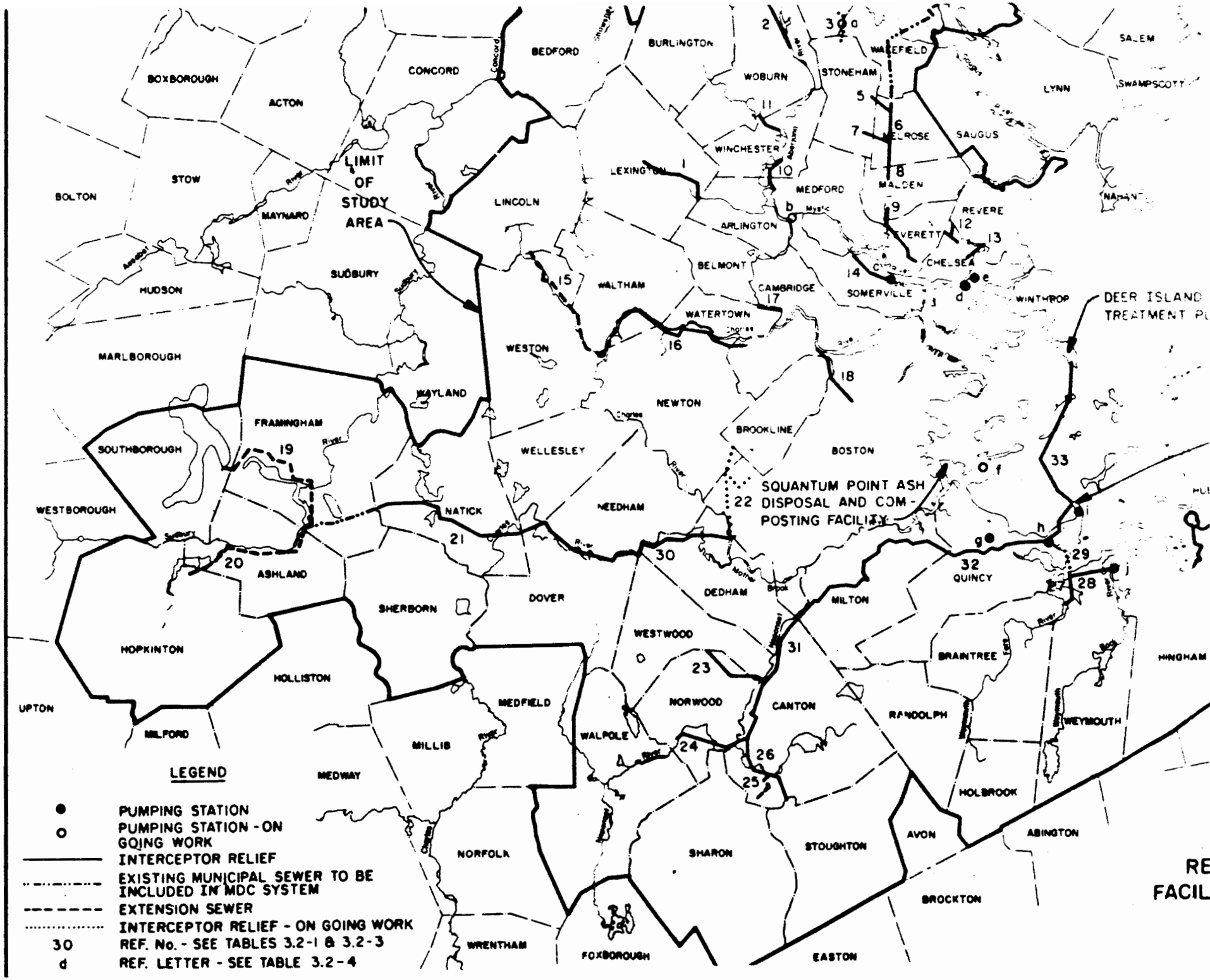
report was prepared for the EPA by the Environmental Assessment Council inc. on the impact of the different options of clean up. It was written before the federal judge denied the MDC a waiver on secondary treatment. Therefore, this study considers no use of secondary treatment as a viable option which it no longer is. Its findings seem to be thorough and unbiased.

? I don't understand this

The Water Quality Standards Summary, a 1971 report to the EPA is inaccurate in its conclusions of feasible procedures. It was written before the 1972 CWA and contains conclusions like, "the cost of separating the combined sewer overflow system is beyond scope of the communities to finance." This is an inadequate conclusion under CWA, which has also made more funds available for such projects.

Many of the descriptions of models came from a collection of abstracts on related studies to the Boston Harbor cleanup. The collection of abstracts was put together for a public symposium on the problem entitled "Science and Policy of Boston Harbor and Massachusetts Bay, Planning for the Twenty-first Century." The symposium took place in November 1985 and was jointly sponsored by the Massachusetts Bay Marine Studies Consortium, the state office of Coastal Zone Management, the New England Aquarium, and several university and SEA grant programs.

My most current source was the Boston Globe, which was more concerned with policy issues than stating current figures on the cleanup process. Thus numbers were fairly hard to come by and may not be quite up to date.



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Boehm, Paul D. and others, "Aspects of Toxic Organic Pollutant Distribution in Boston Harbor".

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Butman, Bradford, "Aspects of Currents and Processes of Sediment Transport in Massachusetts and Cape Cod Bays".

Gallagher, Eugene D. and Judith P. Grassie, "The Successional Dynamics of Capitella Sibling Species in Boston Harbor Sediments."

Shiaris, Micheal P. "Polycyclic aromatic Hydrocarbons in Boston Harbor".

Wallace, Gordon, "Trace Metals in Boston Harbor"

Response to 1st page

As you can imagine, a project of such a great magnitude has had inumerable studies done on it to assess the nature of the natural systens and the way it will be effected, positively and negatively by the proposed project. This makes it very difficult to describe the mechanism behind any one natural systems model. The 1978 EIS, for instance, catalogs inventories for 15 natural systems, including water resources, aquatic biota, terrestrial biota, air quality, population dynamics, and recreational and scenic areas, to name a few, each of which presumeably has a model to describe it. It also documents the impacts on the proposed planof 10 catagories of natural systems, composed of the 15 earlier categories. Presumeably, the models for the environmental inventories consisted of quantitatively gathered data using only one variable. The calculated impacts must be broken down into a number of independent and dependent variables. Looking at water quality, values were derived from present values for the year 2000 for flow rate, BOD5, suspended solids, and 7 different metal concentrations. These values were derived by assuming a 85% removal of total influent mass of BOD and SS.[1] By thsi scenario, flow inceased by 85%, BOD5 and SS fell by 53% and 32% respectively, and the metal concentrations varied from a 17% increase to a 59% decrease from present values.[2] These figures were qualified in the text by other case studies where the input of specific concentrations is already documented.

Another model, concentrating on currents and disperson in

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[1]Greeley and Hansen, vol. 1, table 5, 2-1.

[2]Ibid.

Boston Harbor, called Ocean: The Descriptive-Predictive System, comes from the Harvard Applied Sciences Division. It is an area that little is yet known about, but is a "necessary input into biological and chemical studies." This model takes dynamical model, historical or real time observational data to construct realistic fields of currents, sea level, etc. and transport and mixing of dissolved materials under those conditions.[3]

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[3]Allen R. Robinson and James A. Carton, "Nowcasting, Forecasting and Simulating Currents and Dispersion in Boston Harbor", Div. of Applied Science, Harvard U.

Part II

Cleanup in Boston Harbor:

Evaluating Values and Valuation Methods

A Continued Study

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Introduction: The $1+ billion cleanup project in Boston Harbor, which is just getting underway, has been delayed by both legislative and public protest and a lack of funds for the huge scale project. Noone, it seems, could be opposed to the goals of cleaning up the water in the Boston Harbor for industrial, recreational, and economic uses as well as for aesthetic reasons. The conflict arises when the costs to the metropolitan utility service, the local government, and the metropolitan citizens are considered. The high cost of the project has been the reason that the Metropolitan District Comission has forestalled complying with the Clean Water Act (1972) for so long. Other problems with the funding are that the metropolitan area serviced by this sewer system comprises so many districts that have their own boards and regulations. This has caused great difficulty in reaching a consensus on a plan to upgrade the existing system. Other problems have been with citizen outcries. Residents of areas that are being considered for upgraded facilities or disposal sites have refused to accept the unwanted facilities. There is no question that sewage treatment facilities fall under the locally unwanted land use (LULU) category. These deterences exist in the face of a broad-based movement of active citizens and environmental organizations to meet compliance

Effects to Receptors: The receptors of the proposed cleanup program are those citizens which live near enough to any of the proposed sites of treatment or disposal facilities or their access routes. People who fall into the category of indirect

receptors are the citizens in the local districts who will be effected by loss of tax revenue due to land being taken out of taxable developmental zoning and put into non-taxable public land uses.

Direct receptors of the effects of the cleanup project include people who are effected by noise of construction, odor of close-proximity treatment or disposal site, inconvenience of road closure due to construction or increased traffic load on local access roads due to construction vehicles, and long-term transportation of waste materials, and people who are victims of reduced land value by proximity to treatment or disposal sites. Another direct effect upon receptors is effects of air quality degredation from incineration of primary sludge. This is a less obvious effect that is much more far reaching than the other direct effects.

Noise levels borne by receptors is fairly easily quantifiable in terms of decibels. Such levels are regulated by Massachusetts' laws which provide an easy standard by which noise levels can be measured. The draft EIS proposes that noise levels during operation at the Deer Island site will be under prohibitable levels for residential zoning--the nearest residence being only 700 ft. from the facility, and that the Squantum Point and Nut Island sites are not bordered by residential areas.[1] The noise levels during construction, however, will be

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[1]Greeley and Hansen and Environmental Assesment Council, "Draft Environmental Impact Statement on the Upgrading of the Boston Metropolitan Area Sewerage System," (1978, USEPA, p. 35.)

much higher. The report also mentions that noise and emission levels would be increased by construction traffic and that road closures will effect local users. Emission levels are quantifiably calculated by a URBEMIS-like model using worse case scenarios of each worker driving to the site alone with a 30 mile round trip. The report states that "no significant addition to ambient air conditions" will be caused by this increase in traffic.[2] It also states that neither will there be a major problem caused by traffic noise levels or road closings, because of the accessibility of major access roads.[3]

Indirect receptors would suffer from the loss of tax revenue which could have otherwise been applied to other projects benefitting the community. The report specificly lists 70 acres that would be taken away from the City of Quincy tax rolls which means significant losses in the future because of the development zoning of the land.[4]

Positive receptors will be those benefitting from the 4,400 man-years of labor required for construction, constituting $110 million, and the 385 permanent jobs that will be created for operation of the facilities.[5]

Values: The value predominantly expressed in the analysis of this project is the respect for the monetary values established

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[2] Ibid., p. 34.

[3] Ibid., Pp. 34-38.

[4] Ibid., p. 38.

[5] Ibid.

by the market system. Cost has been the major factor delaying the project up until now, and continues to be the force behind most of the decisions. It is also the force behind some of the opposition to the plan as it is manifested in lowered property values.

Also evident in the value of concern for fair distribution of costs. Communities themselves have seen to this by protesting site locations or any other part of the project which effects their immediate surroundings. The draft EIS is also fairly thurough in its consideration of different factors effecting the local community. It tends to write certain factors into the report, however, without sufficient analysis just to show that such factors were considered.

Concern for preservation of the natural system has also been demonstrated by such groups as the Mass. Bay Marine Studies Consortium, Office of Coastal Zone Managemnt, New England Aquarium, U. Mass.-Boston, Northeastern U., and the MIT SEA Grant Program.[6]

Valuation of Effects: As was evident from the discussion of values inherent in the project analysis, cost-benefir analysis is likely to be the most effective method for allocating the facilites for secondary treatment in the Boston metropolitan area. Cost-benefir analysis, hereafter CBA, would consider the costs associated with a certain plan in relation to the benefits

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[6]Science and Policy of Boston Harbor and Massachusetts Bay, program for consortium of November 13 and 14, 1985.

created by that plan. The costs of the Boston Harbor cleanup are aproximately $1.8 billion plus dollar values of lost property value and taxable commodities. These are compared to the benefit derived from the positive change in water quality, including its inceased demand for industrial uses, increased recreational use, and the economic value of the fisheries which would once again thrive. Thre would also be a potential for huge benefits from waterfront development and increased property values sparked by the improvement of the aesthetic quality of the harbor water. The value of these benefits and potential benefits have not been assessed in any source that has been available to me. This information would have to be obtained for a CBA of this kind.

The question here, however, is not whether to build or not to build, but of what plan to follow inorder to achieve secondary treatment and compliance with the NPDES regulations. This would make necessary a comparative study on the relative benefits of the different proposed plans. Decision analysis works particularly well in this type of comparative study. Decision analysis would set up a decision tree for the different options open for the project. the draft EIS considers these options as the following: Deer Island--Broad Meadows, Deer Island--Squantum Point, all secondary treatment contained on Deer Island, the EMMA[7] plan, a no action plan, and a revised no action plan in

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[7]Wastwater Engineering and Management Plan for Boston Harbor--Eastern Mass. Metropolitan Area, Metcalf and Eddy, Inc., 1976.

which currently planned changes are carried out.[8] To create a decision tree between these options, you would begin with a decision node with six branches coming out of it depicting the six options available. For each, a net cost and a success rate must be considered. Complicating the matter more, for each decision of the location and plan of secondary treatment, there must be added the further decision between options of sludge and effluent disposal. The choices for this, as we see in the EIS is direct release or treated efluent, incineration, landfilling, and composting.[9] Also considered is the prospect of open ocean dumping, but this currently has political constraints that currently prohibit it from being an option.[10] For each of these options, the cost of operation and success rate must also be included.

What this EIS actually attempts to do is a rather loosely formatted site analysis, whereby each plan is evaluated for its success. Because the Massachusetts Water Resources Authority (MWRA) has been ordered by a court of law to engage secondary treatment in the Boston area and to meet water quality regulations, cost is not as much a factor as actually meeting those regulations. The 1978 EIS selects the all Deer Island plan as "the only one which will meet water quality standards."[11]

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[8]Greeley and Hansen, op.cit., Pp. 7-19.

[9]Ibid., Pp. 5,6.

[10]John Robinson, "N.J. Lawmaker Threatens Harbor Funding," Boston Globe, Dec. 20, 1985, p. 3.

[11]Greeley and Hansen, op. cit., p. 20.

The plan correctly states that "inorder to meet NPDES permit requirements for wastewater treatment plant discharges, secondary treatment is required."[12] This eliminates the two no action plans from the options. In a comparison between the Deer Island plans, the EIS concludes that "the all Deer Island plan is superior in terms of the number of sites required; operation and maintenance advantages; lower energy costs, and a more favorable outfall location."[13] Thus though the others were compatible in price and needed less pipeline construction, the all Deer Island plan prevailed. Finally, the EMMA plan was abandoned because it would cause water quality degredation in the Charles and Neponset Rivers, and would require extra construction sites including the filling in of a part of Quincy Bay to expand the Nut Island facility,[14] The assesment fails to mention that the EMMA plan is also less expensive to implement.

A planning balance sheet approach seems like it would be effective in this case to bring in some of the non-quantified considerations of the study. The planning balance sheet (PBS) surpasses a more formal use of cost-benefit analysis in two ways: it records detailed information on the distribution of costs and benefits among different grups of people affected by a proposed plan, and it accomodates formally intangible and unmeasureable impacts by designating "symbols for recording them

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[12] Ibid., p. 24.

[13] Ibid., p. 17.

[14] Ibid.

in evaluation tables alongside monetized impacts."[15] Transfer values are likewise not included in CBA because they represent redistribution of costs and benefits and not actually incurred costs. The redistribution of costs and benefits is important in a PBS approach. This procedure sets up the costs and benefits involved in each impact for both producer and consumer sectors. (See appendix forCBS format illustrated for this example.) This format would be particulary good for the Boston Harbor project, because it embodies both the value of quantified market-specified prices and of fair distribution of costs, the concern for which was demonstrated in the EIS and other literature on the subject. On the other hand, it has already been determined that secondary treatment must be established. The option not to build secondary treatment no matter what the cost to different sectors, according to the U.S. District Court of Appeals which recently denied the MWRA waiver application. The goal now is to determine a plan which has the least monetary, social, and environmental costs. This would require a PBS analysis for each plan which would then be compared in terms of relative costs and benefits to the other plans.

The Goals Achievement Matrix (GAM) analysis is similarly not applicable to this study by the fact that a secondary treatment plan must be carried out regardless of social costs. Even more than PBS, GAM includes a list of community goals by which impacts can be measured. Another weakness of GAM in its

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[15]Donald McAllister, Evaluation in Environmental Planning, (1982, MIT Press, p. 148.)

applicability to this case is that no impacts are monetized. In this situation where government funding and effects of taxation are so important, a non-monetary analysis is not very practical. Furthermore, McAllister says of GAM, "GAM is not very useful if weights cannot be objectively determined or assumed....This seems to place GAM on very shaky ground."[16]

Finally, the different options for secondary treatment in Boston Harbor could be measured in terms of energy analysis (EA). In this method of analysis, everything is reduced to units of energy rather than monetary units. Each of the proposed treatment plans can be compared in terms of their annual energy requirement--the all Deer Island site plan would require 224 million kwh's for operation on an annual basis, for example.[17] Other impacts of the different plans, i.e. energy involved in construction, human labor in kilocalories, and destroyed habitat in terms of kilocalories of biotic material in addition are considered. This value would then be measured against the value of the projects in energy units, i.e. marine life, aquatic vegetation, and industrial benefits. I think that this method has serious limitatios. I do not believe that there is any way that the energy benefits after cleanup will be anywhere near the amount of energy put into secondary treatment. I am sure that you would agree, however, that this does not mean that the cleanup of Boston Harbor is not worthwhile.

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[16] Ibid., p. 168.

[17] Greeley and Hansen, op cit., p. 45.

Conclusion: In my opinion, cost-benefit analysis, in conjunction with detailed impact statements, is the most reasonable method for assessing the best plan for establishing secondary treatment in the Boston metropolitan area. In this situation, there actually are not many aspects of evaluation which are not readily quantifiable. For instance, when assessing the number of construction sites necessary for different plans or the length of the pipeline necessary to connect the sites, you can easily rely on construction costs of both cases to encourage the least amount of destruction. Likewise, the extremely environmentally harmful aspects of underwater dredging will be minimized by the extreme cost of that activity. I think that the most successful treatment system and most effecient land use will naturally come out of this method. The one weakness of CBA is that it does not include the impact to such environmentally sensitive areas as wetlands which do not have a high monetary value because of the fact that they cannot maintain high development levels like other areas. Environmentally sensitive areas and effect on biota can be factored in an informal McHargian-type analysis where such areas known to be environmentally sensitive are avoided by construction.

The options for sludge disposal, perhaps, must be looked at in a different way. It is possible to easily quantify the impact of a landfill, but it is more difficult to quantify the effects on air quality of incineration or the impact on the natural system of open ocean dumping--an option which would no doubt prove to be the cheapest in a CBA scenario. I think

either PBS or a decision tree would make some of these impacts more obvious to a policy maker. (See appendix for examples of both.) The mixture of methods adopted by the 1978 EIS seems to work very effectively. It put the maximum amount that would possibly be demanded by the market into composting. The EIS states that its selection of disposal methods was governed by trying to find alternatives to incineration of all the sludge.[18] Thus composting and landfilling of secondary sludge was adopted for the sothern district secondary sludge. I would like to propose here a method which is in its preliminary stages of permitting, which is ocean incineration. The MWRA having been handed this problem of sludge disposal has been contracting to have it dumped off a point of Long Island and the New Jersey coast.[19] There is no doubt of the harmful effects of dumping sludge into the ocean so close to a high population center, and the New Jersey legislature is trying to have the dumping rite limited to current license holders in New York and New Jersey. Ocean incineration, once it has been made available, will be a much cleaner alternative, not effecting the ocean or coastal systems and presumeably cutting down on air quality degredation from land-based incineration.

Anotated Resources: The MDC application for waiver of secondary treatment which was submitted to the US EPA in June of 1984 is

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[18] Ibid., p. 31.

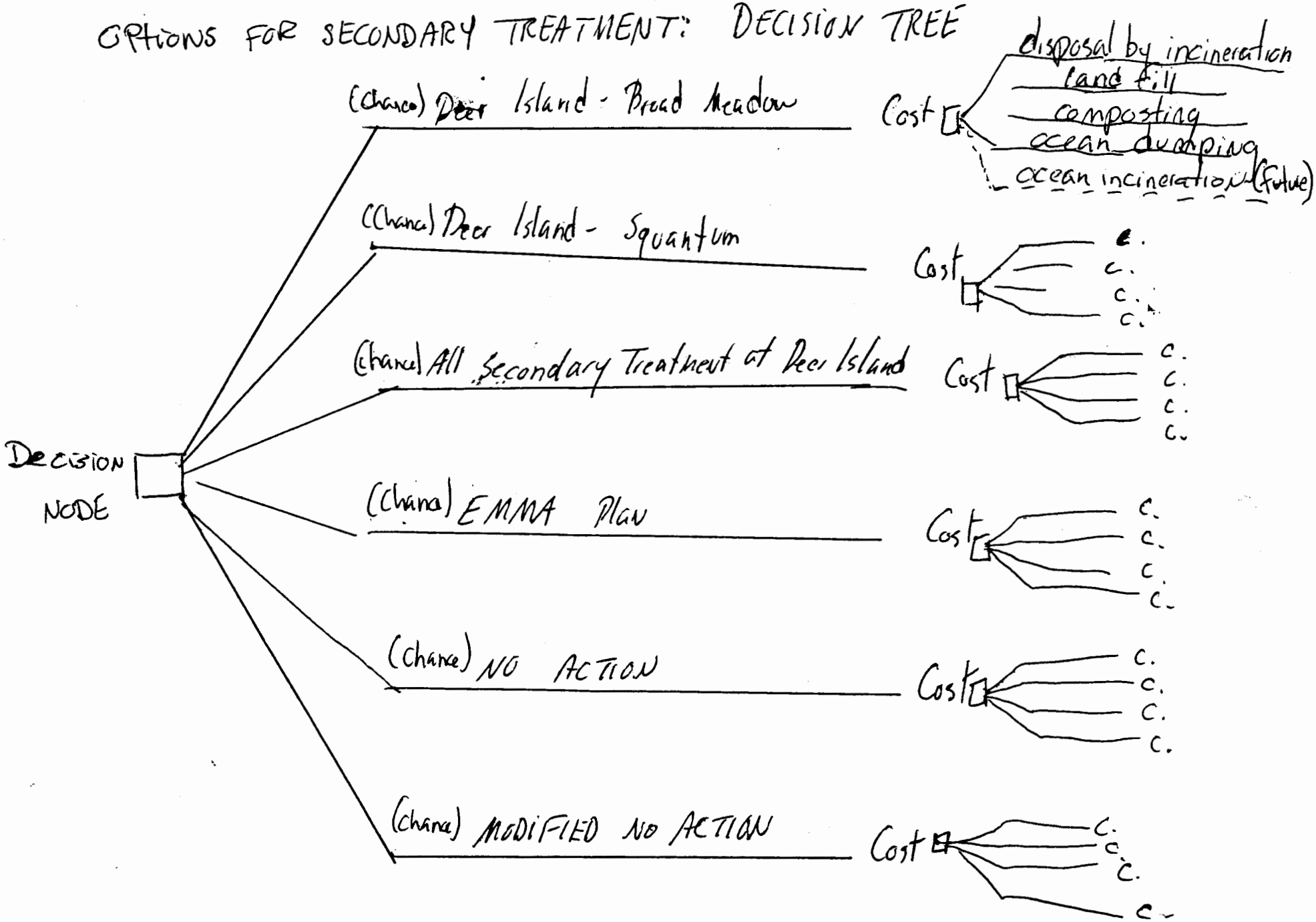
[19] Eileen McNamara, "Muddying up Already Polluted Waters," Boston Globe, Dec, 24, 1985, p. A-21.

one of the most recent and thorough sources on environmental quality in Boston Harbor. It is, however, a waiver application designed to convince EPA that, according to a 1977 modification to the Clean Air Act, it should modify the requirements of secondary treatment in response to MDC's modification and upgrading of the existing Deer and Nut Island facilities. This stated objective could skew the presentation of material infavor of these modifications. This document would also be much more accessible if it contained an executive summary.

The article, "Cleaning Up Boston Harbor, Fact or Fiction?" in the Boston College Environmental Law Review is a very succinct and factual article documenting the history of water quality in Boston Harbor, the development of the MDC treatment process and its impacts, and the current compliance situation under the new regulations. As you would expect, it is a much more legally and politically based source.

The last new source drawn on by this paper is McAllister's Evaluation in Environmental Planning. It was used as a source for some of the valuation and analysis methods. The book gives a very clear and concise evaluation of the different methods of analysis, the advantages and disadvantages, and examples of their implementation which are very useful.

OPTIONS FOR SECONDARY TREATMENT: DECISION TREE



Planning Balance Sheet:

Sector	Benefit	Cost
Producer -		
MWRA	~~tax revenue~~	expenditures
MDC	tax revenue	expenditures
US EPA	compliance	majority of expenses
Consumers		
Receptors	Clean water	property values tax payments
Recreationalists	higher quality recreation	tax payments
Fishery mngrs/ Fishermen	price for catch	tax payments
Developers	better quality waterfront	higher price of prime waterfront land.
general citizens of Boston Met. District	better quality of water	tax payments
US citizens	←	tax payments
Fish + other forms of life	better habitat conditions	—

(McAllister, p 153)

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