MAY 0 1 2002

April 26, 2002

DP 11800
SCC

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P O Box 1229
Galveston, TX 77553-1229

Re: April 4, 2002 Public Notice, Permit Application 21520 (Revised)

Dear Mr. Stanley,

I request that these comments be made part of the permanent record for the Bayport Terminal Facility.

I again wish to express my opposition to the issuance of the permit for the Bayport Terminal Facility. Attached you will find copies of my previous efforts in this regard (Attachments 4-7). 29-5

The April 4 Public Notice has revealed new information concerning jurisdictional wetlands that was not provided in the DEIS. Therefore, I request that the DEIS be reopened for a period of six weeks to allow adequate time to amend comments on the DEIS. 14-75 In addition, there is no comparison of the new figure (18.3 acres – page 2, Attachment 1) and the alternative sites. Also there is a discrepancy between this number and the amount shown on page 25 of the Port of Houston Authority's (POHA) Mitigation Features (Attachment 2). 14-93

USACE states that the application has been revised to include the construction of a 20-foot pre-cast concrete wall along the northern edge of the Bayport Channel (page 2 – Attachment 1). A drawing of this wall was provided, but there was no mention of this issue in the POHA Mitigation Features (Attachment 2). Without some technical analysis that the 20-foot wall is adequate, there is no way to determine its effectiveness. 3-63 However, I do not look forward to a 20-foot concrete wall at the end of my street blocking the summer breezes which we now enjoy. 22-160

I guess I should point out that the POHA pages 24-28 (Attachment 2) is identical to POHA pages 14-18 in the previous Public Notice that we received (November 9, 2001).

From page 4 (Attachment 1) of the current Public Notice, I believe that it is appropriate to comment on the following items:

MAY 0 1 2002

DP 11800

Economics

Four years ago, the POHA projected the cost of this facility to be $1.2billion. I believe that the cost will be considerably higher because:

1. Inflation due to the passage of time.
2. Need for more land than originally projected.
3. Cost of the EIS (POHA originally planned on doing only an Environmental Assessment – which would have been much cheaper for them).
4. Cost of the PHACAG.
5. Additional costs attributable to unplanned mitigations (due primarily to their insistence on the Bayport site and its proximity to so many residences).

These added costs and the cost of road and rail infrastructure would be paid by the taxpayers. I believe these costs make this project economically unfeasible at this location. 6-141

Consideration of property ownership

The POHA apparently does not own all of the property it needs for the Bayport site (see Attachment 3). I believe there may be approximately 200 additional acres needed for build out that are being contested. 4-44

The needs and welfare of the people

The Bayport location has the highest population density of any of the potential sites. The needs and welfare of these people should only be put at risk if there is no other choice available. There are other choices available in this case. 2-160

Thank you for your consideration of these comments.

Barbara Suber

Barbara Suber
3902 Bonita
LaPorte, TX 77571

X 11758

APR 17 2002 April 13 02

Corp of Engineers
Galveston, Texas

Dear Sir
Re: Permit 21520 Revised.
I am not qualified to comment on the technical contents of this application.
My concern is the concentration of a vital industry in one location. Prior to terrorism this was the most logical & efficient way to manage However for security reasons it would seem wise to ~~diverse~~ diversify so one extreme act would not disable the country. 21-58
Thank you for presenting this notice + asking for concerns.

Sincerely

Ellie Childs
1801 Oleander
Dickinson, TX
77539

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4-14-02

APR 17 2002

XP11753

To Kerry N. Stanley and All Concerned,

I, Jill C. Turala residing in LaPorte, Tx am opposed to the building of the proposed major marine terminal. I'm a native Houstonian and have lived in the Seabrook and LaPorte area since 1974. The impact that this terminal would have on our community and environment is in my view numerous and negative. Please don't take away our precious wetlands with all the beautiful species and vegetation they support. I feel as though I'm trying to fight a loosing battle and noone can come against the Port. However I am sad that our community and surroundings will suffer and be left dealing with all the negatives this new port facility will introduce.

29-91

22-157

14-82

22-158

Sincerely,

Jill C. Turala
402 S. Carroll St.
LaPorte, Tx 77571

APR 2 2 2002

XP 11760

April 15, 2002

Mr. Kerry M. Stanley
U. S. Army Corps of Engineers
P. O. Box 1229
Galveston, TX 77553-1229

Mr. Stanley,

I have read the "Public Notice" issued April 4, 2002, re: Permit application no. 21520 (revised). This proposed project located along the Bayport Ship Channel should be stopped. I cannot believe that after all the objections that you continue to consider this project. It clearly violates wetland laws and unless the law monitors the Port of Houston more violations will occur. 29-92

The proposed berm will do absolutely nothing. Have you taken a look at the storage containers along Hwy. 146 in LaPorte? The containers are at least 60 feet high – what good would a 20-foot berm do??? 11-8

Plant vegetation – my haven't we been promised that before. There exists a gas well near that site now and they promised beautiful landscaping to hide the well. That didn't happen. The outfall will in no doubt cause flooding into pine gully and homes on Baywood are now in more danger. One-house floods along pine gully since the county included additional drainage into the gully, more runoff will be a disaster. 25-2

The noise pollution is a drop in the bucket compared to the HEALTH risks that will be caused by the diesel fuel used in all the trucks. 9-78

The traffic is already a major problem on Hwy. 146 in Seabrook. The commuters are now turning down Port Rd. and Red Bluff to Todville to escape the tremendous back up of traffic. This traffic extends from LaPorte on Hwy. 146 southward across the Kemah bridge. Now you're going to approve a project that will add more to this mess??? 27-106

This has been our home for 27 years, but is slowly becoming only a house and one we would like to sell but can't get market value because this project is scaring people away. Please reconsider your decision and DO NOT approve Bayport! 6-135

Thank you,

Diana Moore

Diana Moore
609 Baywood
Seabrook, TX 77586

APR 2 3 2002

April 21, 2002

XP 11761

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U. S. Army Corps of Engineers
P. O. Box 1229
Galveston, Texas 77553-1229

Subject: Proposed Bayport Container Terminal
Reference: USACE Public Notice dated 04 April 2002

Dear Mr. Stanley:

I am enclosing my comments relative to the proposed changes in the Houston Port Authority's application as described in the referenced Public Notice.

(1) Extending berm south of the proposed Cruise Terminal.

The lighting and noise of major concern is that to be generated by the container terminal- - not the cruise terminal. Cruise ships dock in the morning and are gone by early evening whereas container port operations are around the clock seven days a week. Further, cargo activities associated with cruise ships are not in the same league with the elevated container operations. The extension of the berm along the south perimeter of the proposed cruise terminal would have minimal effect on El Jardin residences. 3-52 17-21

(2) Concrete wall along the northern edge of the channel.

The proposed concrete wall would only protect the nearest 120 feet north of the wall from direct line-of-sight to the dockside cranes. This is only a marginal improvement at best. 3-53

(3) Addition of Loblolly Pine trees to the berm mix.

No information is presented on how much, if any, the addition of evergreen to the mix will reduce the DEIS predicted out-of-limits decibel levels. No statement is included which would indicate the size of trees to be planted nor time needed to reach maturity even if some benefits could ultimately be derived from this addition. 3-54

(4) Impact noise reduction systems on wharf "crane spreader bars".

In the DEIS, The PHA had already committed to the lowest level of noise in procurement of equipment so this is not a change. However, the question still remains on <u>what agency has approval authority</u> over purchase of equipment to meet these criteria should the Bayport site be approved. Left to the sole discretion of the PHA, this goal would be unenforceable. 3-55

(5) The USACE is correcting a major discrepancy in the DEIS regarding wetlands.

The referenced Public Notice does not identify the source of the erroneous data. If this information was contained within the HPA application and was accepted as correct by the USACE in the DEIS, it should be grounds for rejection of the application. 23-173

General Comments:

On page 5 of the USACE notice, the statement is made that if no comments are made by 04 May 2002, it will be considered that there are no objections. This could imply that all comments generated during the open period for the DEIS are discarded. 23-174

The additional modifications, as proposed in the 04 April 2002 Public Notice, only constitute marginal improvements at best. Nothing is included on air pollution (especially on the effects of less than 2.5 micron particles), recreation, safety (adjacent public highways) and the "needs and welfare" of a significantly larger residential population than exist at any other of the candidate sites. 23-175

While not a direct responsibility of the USACE, project costs are a concern in public statements by HPA executives. However, the loss of value of residential properties need to be weighed as well. This issue certainly falls into the "needs and welfare of the people". 6-136

Comments received by the USACE during the open period should only be tempered by the extent of the information contained in your referenced Public Notice but these open period inputs are essential in your consideration of this application. 23-176

If the USACE concludes that these superficial changes warrant disgarding all public comments received during the open season then the USACE needs to reissue the revised draft of the DEIS and entertain a new open period for public comment.

Sincerely yours

Richard B. Ferguson

Richard B. Ferguson
419 Cedar Lane
Seabrook, Texas 77586

XP11762

Sally E. Antrobus

526 Surf Oaks Drive
Seabrook, TX 77586-1822
(281) 474-9220

April 21, 2002

Kerry M. Stanley, Regulatory Branch
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Yexas 77553-129
Fax: 409-766-6301

Re: Permit Application 21520 (Revised), Bayport

Comments on April 4 Public Notice

Dear Mr. Stanley,

Noting that the Corps has revised its estimate of the acreage of jurisdictional wetlands on the site of the new Bayport facility proposed by the Port of Houston Authority, I submit that the Corps should not issue a permit for Bayport because there are other alternative sites that require filling less jurisdictional wetlands. 14-73

Both Shoal Point and Spillman's Island have smaller areas of jurisdictional wetlands than are identified at Bayport. Under EPA's 404(b)(1) guidelines, as I understand them, the Corps is *required* to deny a permit for Bayport if there is a practicable alternative site that requires the filling of less wetland acreage. At the very least, the Corps should conduct detailed analysis of the Spillman's Island alternative. It is a viable alternative. 14-74

In addition, the total acreage of wetlands on the site has changed from the documentation in the Bayport DEIS. We who responded to the DEIS thus did not have this information. Since this wetland data was not provided in the DEIS, I urge you to reopen the comment period on the DEIS for six weeks to allow us to amend our comments on the DEIS. 14-75

I note, too, that the noise barrier has been changed in this public notice, and a concrete barrier noise wall has been added north of the Bayport channel. Once again, public comments on the DEIS may be compromised because they were based on computer modeling of a particular wall configuration on the east side of the property and no noise wall on the north. There has been no opportunity to assess the environmental impact of a noise wall on the north side of the channel. Again, we need the period for comments on the DEIS to be reopened to receive comments on the change in the noise barrier. 3-51 23-170

As you are perhaps aware, the Port of Houston Authority does not have title to all of the land shown in the permit application. Some landowners have told the Corps that they do not intend to sell their property, and the City of Seabrook and possibly others have informed the Port that they will not allow condemnation within their municipal boundaries. According to the Corps regulations, the Port represents that it has title to the land in the 23-16

11762

application or has the ability to gain title to the land. It would appear that the Port of Houston cannot make this representation in good faith. I urge the Corps to investigate this issue. Misrepresenting their ability to obtain this property in a permit application is a federal criminal offense.

I filed comments to the DEIS in a letter written to you on March 4, 2002. I continue to oppose the project , and oppose the issuance of a permit for it, and I want to make sure that my comments filed in March in response to the DEIS continue to be considered. Those comments are also pertinent to the April 4 Public Notice and I would ask you to include my original DEIS comments letter (following) in my comments upon the Public Notice.

I am submitting these comments to the TNRCC as well as to the Crps of Engineers, requesting that a public hearing be held by the TNRCC on this resubmitted application. 23-171

The April 4 revised Public Notice significantly changes a number of the issues that were addressed in the Bayport DEIS. I therefore respectfully request reopening of the DEIS comment period . 23-172

Sincerely,

Sally E. Antrobus

~~11762~~

Previously Submitted
DP 11078

March 4, 2002

Mr. Kerry Stanley
U.S. Army Corps of Engineers
Galveston Regulatory Branch
P.O. Box 1229
Galveston, TX 77553-1229

Dear Mr. Stanley,

Bayport DEIS Comments

RE: Port of Houston Authority's Proposed Bayport Container Terminal, Department of the Army Application Number 21520

I urge the Corps of Engineers to deny the application by the Port of Houston Authority for section 10 and Section 404 permits to build a container port at Bayport, for two reasons.

(1) The Port of Houston Authority has shown amazing arrogance, manipulation, and most recently fraud in the course of trying to get this proposed project permitted.

The Port has submitted an illegal permit application because it does not own all the land shown in plans accompanying the application (most recently revised in October 2001), and it cannot reasonably expect to acquire this land.

The Corps' own rules indicate--right on the application!--that the applicant's signature affirms possession or pending acquisition of the property involved, and that penalties for misrepresentation are a fine of up to $10,000, five years' imprisonment, or both. The Bayport permit application involves several tracts of land not owned by the Port of Houston Authority. One belongs to American Acryl, which has told the Port they will not sell it. Other land lies in the City of Seabrook, where the Port cannot condemn land without the consent of the City. The City of Seabrook has not granted the Port authorization to condemn land within the city.

The signature of a port official on such an application is illegal, and it is presumptuous in the extreme. Apparently this agency believes itself to be above the law. The only reasonable course of action by the Corps of Engineers is to deny such a permit application.

(2) Construction of a container terminal at Bayport is very, very clearly not in the public interest.

You will have noted the impressive chorus of vocal opposition to it by citizens and by a full suite of elected officials, including the school boards of the La Porte and Clear Creek Independent School Districts; the mayors of Pasadena, Seabrook, Shoreacres, Taylor Lake Village and other nearby cities; and state legislators including Representative John Davis and Senator Mike Jackson.

11762

This kind of wide-ranging opposition to a project is precisely what the public comments component of the Environmental Impact Statement process is designed to capture. When such unprecedented numbers as 2,500 angry people come to the scoping meeting for a project, and more than 3,000 come the public hearing on the draft EIS, it should be blindingly clear to the Corps that the public opposes the plan for many reasons.

Better alternative sites are available to serve the needs of the container industry, yet the analysis of these alternative sites in the DEIS is distinguished by omissions and flaws. There is a clear bias toward Bayport in the document.

Some of the specific shortfalls in the DEIS are:

- Misrepresentation of the extent of wetlands on the site
- Total absence of analysis of fine particle air pollution that would result from this port
- Total absence of evaluation of the effects of a 50-foot-deep ship channel, despite planned wharves engineered to 56 feet
- Inadequate traffic assessments
- Failure to disclose land use impacts contrary to the public interest, including property value declines
- Total absence of analysis of the cumulative effects of adjoining Bayport and San Jacinto Rail proposed projects

When assessed honestly, a whole series of aspects of this project are open to challenge under federal law--law regarding wetlands, air pollution, cumulative impacts, environmental justice, and even the execution of the permit process itself.

Knowing all this, to grant this permit would be to open the Corps itself to charges of abuse of public trust. Citizens are concerned about the ethics of government. By turning a blind eye to the problems in the Bayport permit application and DEIS, the Corps would be committing the same sin as the Enron executives who seem to have carefully avoided knowing too much about how their corporation worked.

Yours faithfully,

Sally E. Antrobus
Ecotourism Committee
City of Seabrook

XP 11763

DRUSILLA DICKSON
502 Pine Gully Road
Seabrook, TX 77586
281-474-2494

April 21, 2002

Kerry M. Stanley, Regulatory Branch
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-129
Fax: 409-766-6301

Re: Permit Application 21520 (Revised), Bayport

Comments on April 4 Public Notice

Dear Mr. Stanley,

The Corps having now revised its estimate of the acreage of jurisdictional wetlands on the site of the new Bayport facility proposed by the Port of Houston Authority, I submit that Bayport permit should be denied because there are other alternative sites that require filling fewer acres of jurisdictional wetlands. Both Shoal Point and Spillman's Island have smaller areas of jurisdictional wetlands than are identified at Bayport. 14-73

As I understand it, under EPA guidelines, the Corps is required to deny a permit for Bayport if there is a practicable alternative site that requires the filling of less wetland acreage. At the very least, the Corps should conduct detailed analysis of the Spillman's Island alternative. 14-74

The total acreage of wetlands on the site has changed in the Public Notice from the documentation in the Bayport DEIS. We who responded to the DEIS thus did not have this information. I therefore urge you to reopen the comment period on the DEIS for six weeks to allow us to amend our comments on the DEIS. 14-75

11763

Now that the noise barrier has also been changed in this public notice, and a concrete barrier noise wall has been added north of the Bayport channel, once again public comments on the DEIS may be compromised because they were based on a different configuration. 3-57
People living north of the channel have had no opportunity to assess the environmental impact of a noise wall threre. Again, we need the period for comments on the DEIS to be reopened to receive comments on the changes. 23-170

I filed comments to the DEIS in a letter written to you in March, 2002. I continue to oppose the project , and oppose the issuance of a permit for it, and I want to make sure that my comments filed in March in response to the DEIS continue to be considered. Those comments are also pertinent to the April 4 Public Notice and I would ask you to include my original DEIS comments letter (following) in my comments upon the Public Notice.

I am submitting these comments to the TNRCC as well as to the Crps of Engineers, requesting that a public hearing be held by the TNRCC on this resubmitted application. 23-171

The April 4 revised Public Notice significantly changes a number of the issues that were addressed in the Bayport DEIS. I therefore respectfully request reopening of the DEIS comment period . 23-172

Sincerely,

Drusilla Dickson

Drusilla Dickson

11763

DRUSILLA DICKSON
502 Pine Gully Road
Seabrook, TX 77586
281-474-2494

Mr. Kerry Stanley
U.S. Army Corps of Engineers
Galveston Regulatory Branch
P.O. Box 1229
Galveston, TX 77553-1229

Previously Submitted comments

Dear Mr. Stanley,

BAYPORT COMMENTS

RE: Port of Houston Authority's Proposed Bayport Container Terminal
Department of the Army Application Number 21520

As a long-time resident adjacent to Pine Gully creek, and a former Park Board member for the City of Seabrook--(which recently received an award from the Texas General Land Office for its wetlands conservation plan)--I am especially conscious of the importance of conserving wetlands.

I am therefore dismayed at the claim in the draft Environmental Impact Statement for the proposed Bayport project that only 2.5 acres of wetlands on the site are considered "jurisdictional" by the Corps of Engineers. With respect, this is a claim readily open to challenge.

There are **extensive seasonal wetlands** on this site. Prairie potholes are a characteristic wetland type there, and nearly all of these wetlands are within a mile or less of the Galveston Bay shore. Portions of the land drain into Pine Gully. Downstream of the site on Pine Gully is the flagship park in the Seabrook park system, Pine Gully Park.

As you must be well aware, a number of studies of the site's hydrology have been commissioned by the Port of Houston Authority since it purchased the land several years ago. All of these studies have been by reputable environmental firms, and they have identified wetland acreage ranging up to and above 100 acres--in one case even above 200 acres. In an area of close to 1,000 acres on the Texas Coastal Plain, like the Bayport site, it is no surprise to find that kind of proportion of the acreage displaying wetlands characteristics.

What *is* surprising is to find the Corps of Engineers claiming only 2.5 jurisdictional acres in the Bayport DEIS, in view of the much larger acreages identified in all earlier studies. When the level of regulatory scrutiny of a project by the state is much greater if over 3 acres of wetlands are affected--that is, when the TNRCC cut-off for **tier II review** is impacts of 3 acres or more--it is difficult to escape the feeling that a claim of only 2.5 "jurisdictional" acres may be an attempt to ensure that the permit applicant is subject only to the much less stringent tier I review.

This does not bespeak the Corps taking environmental responsibility for wetlands seriously. It looks dangerously like a cop-out.

11763

Further, you will also doubtless be aware that more than six miles of ditches were dug on portions of this property close to the time of its acquisition by the Port of Houston Authority. The purpose of that ditching appears to have been to drain the site. Regardless of who dug those ditches, or why, examination of recent aerial photography of the site shows that the ditches have had the effect of connecting at least some of the wetland acreage on the site to Pine Gully.

In the event that a legal determination has to be made, these wetlands are higly likely to be considered to have the "adjacency" to waters of the United States that is needed for them to be considered "jurisdictional," and there is little question that the acreage concerned amounts to substantially more than 2.5 acres.

There are other faults in the DEIS analysis of wetlands impacts too. Likely wetland losses at sites considered as alternatives to Bayport are called a "**long-term adverse impact.**" But the loss of similar wetlands at Bayport ("jurisdictional" or otherwise) is not called a long-term adverse impact. Why not? This appears to indicate bias toward Bayport in the evaluation.

The assessment of **flooding potential** again contains weaknesses. Several of the alternative sites are on islands, but Bayport is an upland site, which means that runoff from extensive impermeable development will potentially affect downstream and adjacent properties, whereas the runoff from most alternative sites would go directly into the bay. But there is no comparative assessment of this in the DEIS. The detention plans offered in the DEIS are merely suggestions and have not been modeled to see if they will work. Flooding is a potentially major concern when more 1,000 acres of hard surface are to replace a natural sponge.

Proper handling of wetland conservation is a make-or-break proposition for to the Bayport permit application. The analysis needs to be complete, and the DEIS must do justice to the mandate of the Corps of Engineers to safeguard wetlands against damage and loss. I respectfully submit that a supplemental DEIS is needed to bring the Corps into a position of dignity as regards its mandates under federal law.

Yours sincerely,

Drusilla Dickson

cc: Lt. Gen. Robert B. Flowers, HQ US Army Corps of Engineers
Colonel Leonard D. Waterworth, Galveston District Engineer and Commanding Officer
Rep. Nick Lampson, U.S. House of Representatives
Sen. Kay Bailey Hutchison, U.S. Senate
Sen. Phil Gramm, U.S. Senate
Rep. Sheila Jackson Lee, U.S. House of Representatives
Rep. Kenneth E. Bentsen, Jr., U.S. House of Representatives
Rep. John Culberson, U.S. House of Representatives
Rep. Tom DeLay, U.S. House of Representatives
Rep. Gene Green, U.S. House of Representatives
Mayor Lee P. Brown, Houston
Shelley Sekula-Rodriguez, Houston City Council

APR 2 3 2002

XP 11764

April 22, 2002
410 Woodvine Drive
Seabrook, TX 77586

Mr. Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U. S. Army Corps of Engineers
P. O. Box 1229
Galveston, TX 77553-1229

I read with considerable interest your "Public Notice" dated April 4, 2002 concerning the Bayport Terminal Project. I was extremely disappointed that it completely failed to address any of my concerns about **SAFETY OR AIR POLLUTION** aspects of the project. Details about berms and loblolly pines don't help at all with my worries about hazardous material spills, transport or handling, or accidents or emissions from 16,000 truck trips per day in my neighborhood. 23-177

It is not at all clear what your document is intended to accomplish. It almost seems that you feel this will be the end of any further public comment. I request we receive and be allowed to comment on a Supplemental Draft EIS that honestly addresses previous public inputs. 23-178

Richard J. Gillen

Richard J. Gillen

APR 2 3 2002

702 Whitecap Drive
Seabrook, Texas 77586
4/19/02

XP11765

Kerry Stanley,

I wanted to provide you my comments to be used as objections to Port of Houston Bayport Terminal project. 29-91
I have read the summary of changes to the project sent me by the Corps of Engineers. And [while using propane powered fork lifts, when available, is a nice touch, the "Bayport Terminal Mitigation Features" dated 10/11/2001, Permit application 21520, fails to address the basic problem.] 7-143
Building this project as proposed will result in the increase of air pollutants in Harris county while at the same time Harris county is imposing draconian measures, such as the 55 mile per hour speed limit or 7-144

limiting the hours lawns can be mowed, to reduce the very same pollution the Port of Houston is increasing.

How can the Corps of Engineers, in all good conscious, fail to stand up and protect the citizens? Either we have a problem or we do not! Failing to fairly report that a half dozen ships with diesel engines and literally thousands of trucks per 24 hours, seven days a week and all the support, ie. trains and employee cars, will not offset all the efforts of the county driving 55 miles per hour is irresponsible. 7-145

If we have an air pollution problem in Harris County, we cannot have the Bayport Terminal. 7-146

Sincerely

Dan W. Gillespie

XP11766

APR 25 2002

422 Baywood Avenue
La Porte
Texas 77571

April 23, 2002

To Whom It May Concern:

In response to the package of information I received requesting input on the proposed Bayport Terminal I would like to express my strong opposition to the siting of this facility.

I have lived in Shoreacres for 25 years. During that time I have seen development take place in many different forms. Some good, some not so good. However, the one thing that has happened that impacts the quality of life in the neighborhood in a deleterious way is the high volume of heavy traffic that one can witness daily along Hwy 146. Add to this the very dangerous traffic congestion caused by the many times each day that trains at both Choate Road and Port Road intersections shunt and re-arrange their cargo and you have a traffic nightmare. The quality of air has deteriorated with these large vehicles pumping out their carbon monoxide as they idle waiting for their opportunity to move on. The Bayport facility would only serve to worsen what is already a bad situation. A monumental increase in both trucks and trains is inevitable should a facility of the size proposed be built. One can only imagine the miserable situation this will create. No one will want to remain in the area of Shoreacres which will almost certainly impact property prices. Who could blame anyone for not wanting to live there, as iit will become almost impossible to get in our out of the edition without a 15 minute wait one way or the other. The joy of being 40 minutes from downtown will be lost when you encounter the snarl ups on Highway 146 before ever making it to the new and improved Hwy 225.

27-107

7-142

27-108

The issues on which I would reject this proposal would be on traffic congestion for which I have seen no answer proposed and quality of air. Neither of these two concerns were addressed to my satisfaction either in writing or at the hearing at George R. Brown recently.

29-93

It has been a great disappointment to me to see the bias that exists by the Corp, it's as if they have a vested interest in making this happen. I certainly don't feel that this has been an impartial investigation. I will never again believe anyone who advertises an "impartial hearing" as a means to determine what's best for an area. It has certainly not worked with this one!

23-109

Sincerely,

APR 26 2002

XP 11767

April 25, 2002

Mr. Kerry M. Stanley
U.S. Army Corps of Engineers
Galveston District
Regulatory Branch
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

Please accept, record, and file this letter as comment regarding the revised 21520 application for the proposed Bayport Marine Terminal.

Homes to the north side of the Channel will experience disruptive amounts of noise. The DEIS notes that construction noise alone during the nighttime would exceed 55 dBA (decibels, A-weighted sound level) at the nearest residences for dredging, and the nighttime pile construction would exceed 55 dBA at the nearest residences. Operation sound levels at the residences north of the Channel would increase 16 to 22 dBA and exceed 65 Dba Ldn. Two of the alternate sites listed would not increase noise pollution or disturb area residents. 3-41

The inclusion of a concrete wall north of the channel per the revised 21520 application will provide little if any buffer against the USACE confirmed excessive noise impacts of the project to me and my neighbors of Bay Colony, LaPorte. Acoustical analysis of the proposed concrete wall approach shows it to be virtually ineffective in buffering Bayport construction and operation noise. 3-56 The issue of significant quality of life threatening noise to residents north of Bayport has not been resolved by this revision. Accordingly, the USACE should rate the Port of Houston permit application a failure in meeting this criteria. 3-57

Sincerely,

M. J. Manering

APR 3 0 2002

XP 11763

Kirk L. Dunham
2811 Carmel Woods Dr.
Seabrook, TX 77586

April 28, 2002

Regulatory Branch, CESWG-PE-RB
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

RE: Permit Application No.: 21520 (Revised)

Attn.: Kerry M. Stanley

Dear Kerry,

I have read the U.S. Army Corps of Engineers and TNRCC Public Notice of Permit Application no.: 21520 (Revised), dated 04 April 2002, and would like to offer the following comments:

1. It is my understanding that the COE MUST DENY the permit to the PHA if there are alternative sites that require the filling of less wetland acreage, i.e.: Shoal Point and Spillmans Island. Also due to the rapidly changing number of wetland acres considered for the PHA's permit, more time is needed to establish the actual acreage and study the environmental impact if it is lost. I also disagree with the area that the Port is using to mitigate their wetland destruction. Red Bluff Road is a major thoroughfare and will someday have development all along it. Isn't it better to leave these wetland areas in a more isolated area so that they are not encroached upon by development? 14-73 14-75 14-81

2. I think the change in the permit application regarding the noise wall needs to be studied further. A concrete wall may stop noise going one way but may reflect it another. If this facility is going to create that much noise, shouldn't it be placed further away from a heavy residential area? 3-5

3. The Port of Houston does not have title to all of the land affected by the permit. Can I apply for a permit for the same land even if I don't own it? A number of entities are going to fight the Port to maintain ownership of their land. I request that the entire EIS be halted until it is determined what land we are talking about. Has the Port misrepresented its land ownership in its application? If so, isn't this a criminal offense? 23-16 & 23-23

Permit Application No.: 21520 (Revised) April 28, 2002

4. I believe the time allowed the public to study and comment on these changes is too short. More time is required and another public hearing to insure that everyone is informed that the Port is changing its application and can potentially change it again in the future. 23-178 23-183

5. I would request that you continue to take into consideration my previous comments made in writing and orally at your hearings. Specifically the need to study the air pollution effects of emissions from the estimated 7,000 diesel trucks a day along with the unfiltered, untreated diesel emissions from ships and locomotives? The scenario you have studied could best be described as "What if they built a container terminal and nobody uses it" How realistic is that? The residents will have to inhale and suffer the effects of these emissions whether you chose to consider them or not. How can an Environmental Impact Study stand up in court if it doesn't consider the environmental impact? 7-32

6. Since the TNRCC seems to now be involved, I would request that a public hearing be held in order that they my see and hear for themselves the opposition to this poorly placed project. 23-171

7. Please don't let the Port and their organized labor force sway you on the economic issues. This is not the only way to make money. Remember the "E" in EIS does no stand for Economy!! 6-137

8. Please extend the comment period. It is better to find out all the information now than to plunge blindly ahead. 23-184

9. All of the other alternative sites combined do not adversely affect as many of the non-port related public as the Bayport location. This should be enough in itself to deny the permit. Please don't let money interests sway you from your charge of protecting the environment. 24-84

Thank you for taking our comments. Please deny this permit.

Kirk L. Dunham,
Master Mariner, U.S. Merchant Marine

APR 3 0 2002

XP 11770

FRANCES AND BOYCE V. JONES
3522 MIRAMAR DRIVE
SHOREACRES, TEXAS 77571

April 29, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Subject: Permit Application Number 21520-revised

Dear Mr. Stanley:

Thank you for this opportunity to once again petition you with my primary grievances concerning the proposed Container/Cruise Terminal.This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application. I remain astonished that the Corps of Engineers has not and still do not address appropriately the issues that I and other citizens of this community have expressed in the various communications and meetings conducted expressly for the purpose of obtaining public concerns and comments. 23-181

The comment period for the revised permit application should be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-182

My comments and suggestions follow:

In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application. 23-16

The Corps of Engineers should not issue a permit for Bayport. The EPA guidelines require that the Corps deny the permit if there are practical alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require 14-74

filling fewer acres of wetlands. These alternatives are clearly practical.

The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is such an important issue, the DEIS should be reopened for comments to allow the public to amend its comments. 14-75

Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impact of a concrete barrier on drainage and flooding in the area should be examined in an updated DEIS. 25-13

In summary, I remain opposed to the Bayport site for a new container terminal. It would create unavoidable and unacceptable negative impacts to our citizens and local communities and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. Thank you for your consideration of this very important matter to me and my family. 29-91

Sincerely,

Boyce V Jones

Boyce Jones

2002
APR 30 2002

May 1, 2002

XP 11773

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

- The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS). I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. I have included the previous comments with this letter for your convenience. 22-91

- The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

- The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-182

- In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-16 22-44

Specific comments on the revised permit application are as follows:

- The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 14-74

- The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-73

- The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since an understanding of these impacts should be provided in the DEIS, the DEIS should be reopened for comments. 22-159

APR 12

11773

- The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular: 3-59

  - Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated. 3-60

  - The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13

  - Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13

  - The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 23-185

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-91

Thank you for your consideration of this important matter.

Sincerely,

Steve Gallington

Steve Gallington
811 Oak Leaf
La Porte, TX 77571
(281) 470-7744
(832) 754-4128 (mobile)
stevegal@neosoft.com

APR 3 0 2002

11773

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Previously submitted comment DP 10176

Mr. Stanley:

Thank you for sending the Public Notice to me regarding the Corps of Engineers' pending approval of the Port of Houston Authority's application for permit for the Bayport Container Port. I will certainly be at the public hearing on December 12th with my family to protest this unwanted and unneeded development.

I know this has been a difficult and contentious process for you; clearly the Corps of Engineers doesn't have the resources or capability to address an EIS project of this magnitude. This is made especially apparent by the draft results of the study. Despite the preponderance of evidence against the project, you will allow the PHA to build this white elephant and destroy my home and way of life along with thousands of others. To be specific, here is a summary of the gross omissions and mistakes you have made (I have put them in order as listed in the Public Notice):

Jurisdictional Wetlands: In 1998, the PHA identified 209 acres of Jurisdictional Wetlands on the site. Their application was later changed to only 2.5 acres of Jurisdictional Wetlands. Where did the other 206.5 acres go? Aerial photographs of the site show that the PHA systematically (and illegally) drained these wetlands. The EPA and Corps of Engineers needs to investigate this clear violation. You don't grant permits to environmental criminals!

National Register of Historic Places: The Houston Yacht Club is a Texas Historic Landmark. It is the oldest yacht club in Texas, over 100 years old. It would be the headquarters for the sailing venues of the 2012 Olympics should Houston be selected as the host city. The club is less than 600 yards away from the development site. Already, the club experiences significant damage due to wakes of passing ships in the Houston Ship Channel and Bayport Ship Channel. With 23 additional ships a week calling on the new port, this historic and valuable site would be destroyed.

Public Interest Review Factors: You have completely ignored so many things in this section; it's hard to be brief. Let me just highlight a few that are of extreme importance to me:

1) The effects of small particle pollution from the expansion: I have a son who will be starting school at Bayshore Elementary next fall. Bayshore Elementary is about 1/2 mile North (downwind) of the proposed facility. Studies indicate that the overall mortality rate at the school will rise 1% due to small particle pollution alone. How can the Corps of Engineers state that they have reviewed "the needs and the welfare of the people" when this project will put MY SON and hundreds of other schoolchildren at risk of early death?

2) The regional effects of 7,000 additional trucks on the road every day: There is only one road out of Bayport. State highway 146 is already congested as the tens of thousands of residents in the area commute to NASA, industrial sites, and their businesses every day. 146 is a major route for school buses. 7,000 heavy, loud, dirty trucks every 24 hours (292 every hour, 5 every minute!) will turn 146 into a parking lot 24x7x365. More than inconvenient, this will kill the businesses in La Porte. The trucks will also kill people, by accident, to the tune of several dozen additional deaths a year. The PHA asserts that once the trucks/ trains are off the port property, they are not their problem. That's why the Corps of Engineers needs to look into the REGIONAL impact of the project. You have simply not done that.

3) The "slum effect": The PHA pays no taxes. It is, in fact, a tax burden on everyone in Harris County. The Bayport Container Facility will also reduce tax revenues in the surrounding area, by killing local businesses that do pay taxes. With local business gone and the environment compromised, the area around the port will become an industrial slum. Weedy, empty lots and stacks of rusty, abandoned containers will stand where businesses and residents once thrived. The loss in tax revenue will be

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immense. It may take 15 years to fully happen, but it will. You have to look no farther than the Port of Los Angeles to see the long term effects of an out of control Port Authority.

4) Property Values: Just the threat of this project has already decreased property values in my area. I love La Porte, and I love the neighborhood I live in. I will be forced to take a loss on my house and move away, however, should the expansion be built. How can I put my family at such risk?

Mr. Stanley, I went to the Colorado School of Mines and hold a degree in Geophysical Engineering. I was required to take several classes from the Corps of Engineers (map reading and concrete engineering), I guess to let them pitch ROTC to me! Many of my classmates went into careers with the Corps after college, and I have met many folks in the Corps of Engineers through my involvement with the United States Power Squadrons. I have always been impressed with the Corps of Engineers' professionalism, objectivity and skill. Until now. To permit this project in the face of all of damage it will do shows how corrupted the EIS process has become at the hands of the Port of Houston Authority.

No amount of burms, trees, buffer zones or light shields will mitigate the massive damage that this project will cause to the Galveston Bay area. **The only viable solution is to deny the PHA'a permit application. Period.**

Not only will the Corps of Engineers be implementing the will of the people, you've be saving lives and $1.2 Billion of our money.

Sincerely,

Steve

Steve Gallington
811 Oak Leaf
La Porte, TX 77571
(281) 470-7744
(832) 754-4128 (mobile)
stevegal@neosoft.com

MAY 0 1 2002

XP 1181

3815 BONITA LN
LA PORTE TX
77571 - 7320

APRIL 30, 2002

KERRY M. STANLEY
REGULATORY BRANCH, CESWG-PE-RE
U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 1229
GALVESTON TX 77553-1229

RE: APRIL 4, 2002 PUBLIC NOTICE, PERMIT APPLICATION 21526 (REVISED)

DEAR MR. STANLEY,

I REQUEST THAT THESE COMMENTS BE MADE PART OF THE PERMANENT RECORD FOR THE BAYPORT TERMINAL FACILITY.

I WISH TO EXPRESS MY OPPOSITION TO THE ISSUANCE OF THE PERMIT FOR THE BAYPORT TERMINAL FACILITY. 29-91

THE APRIL 4 PUBLIC NOTICE HAS REVEALED NEW INFORMATION CONCERNING JURISDICTIONAL WETLANDS THAT WAS NOT PROVIDED IN THE DEIS. THEREFORE, I REQUEST THAT THE DEIS BE REOPENED FOR A PERIOD OF SIX WEEKS TO ALLOW ADEQUATE TIME TO AMEND COMMENTS ON THE DEIS. 14-76

IN ADDITION, THERE IS NO COMPARISON OF THE NEW FIGURE (18.3 ACRES) AND THE ALTERNATIVE SITES. ALSO, THERE IS A DISCREPANCY BETWEEN THIS NUMBER AND THE AMOUNT SHOWN ON PAGE 25 OF THE PORT OF HOUSTON AUTHORITY'S MITIGATION FEATURES. 02-175 14-85

(CONTINUED)

USACE STATES THAT THE APPLICATION HAS BEEN REVISED TO INCLUDE THE CONSTRUCTION OF A 20-FOOT PRE-CAST CONCRETE WALL ALONG THE NORTHERN EDGE OF THE BAYPORT CHANNEL. A DRAWING OF THIS WALL WAS PROVIDED, BUT THERE WAS NO MENTION OF THIS ISSUE IN THE POHA MITIGATION FEATURES. WITHOUT SOME TECHNICAL ANALYSIS THAT THE 20-FOOT WALL IS ADEQUATE, THERE IS NO WAY TO DETERMINE ITS EFFECTIVENESS. 3-63

I DO NOT LOOK FORWARD TO HAVING A 20-FOOT CONCRETE WALL AT THE END OF BONITA LANE BLOCKING THE BREEZES WHICH WE NOW ENJOY. 22-160

SINCERELY

Catherine B. Hain

Sigler, 695 F. 2d at 974; see also, Scientists' Institute for Public Information Inc. v. Atomic Energy Commission, 481 F. 2d 1079, 1092 (D.C.Cir. 1973).

On the eve of the release of the Final Environmental Impact Statement, the Corps acknowledges, for the first time, impact on 310 acres of open water habitat. This impact is likely due to dredging activity required by the project. Despite the Corps own declaration that further deepening of the entire Houston Ship Channel will be necessary, no analysis of the environmental effects of such dredging, the likely open water habitat to be destroyed, and the impact on aquatic life in the Bay system has even been attempted.

D. The DEIS Fails To Contemplate Disclosure of All Environmental Impacts. 23-201

A permit, which is granted without full disclosure of a project scope, requires such a permit be reconsidered. *Taylor v. U.S. Army Corps of Engineers, 567 F. 2d 1332 (5th Cir. 1978). "The primary function of an environmental impact statement under NEPA is to insure a fully informed and well-considered decision." Sierra Club v. United States Army Corps of Engineers, 701 F. 2d 1011, 1029 (2nd Cir. – 1983).* In order to fulfill its role, an environmental impact statement *"must set forth sufficient information for the general public to make an informed evaluation." Id.*

The public notice document is overbroad in its discussion of wetlands, not specific on the basis for the delineation made and unclear on why the overall number of acreage wetlands is larger than the original study area contemplated by the DEIS. Consequently, as a result of the public notice document, the Foundation is not able to ascertain the scope of the project, the nature of the specific wetlands delineations and the specific methodology and criteria followed in evaluating the basis for the wetland delineation. Additionally, the Corps fails to make any analysis of 14-94

1. The impact of the destruction of 310 acres of open water habitat; 12-54

2. The expected impact of the destruction of an unknown quantity of open water habitat due to the deepening of the channel to 50 feet, and 12-2

3. The impact on aquatic life and the overall health of the Bay due to the dredging and deepening to a 50 foot channel.

Therefore, the DEIS process fails to provide adequate and full disclosure and prevents the Foundation from making an informed evaluation. On this basis, the Foundation requests that a new DEIS be rewritten with a comprehensive discussion of the wetlands delineations and impacts along with an adequate analysis of the impact of the destruction of open water habitat.

MAY 0 6 2002

April 29, 2002

XP11803

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Re: Public Notice per Permit Application No. 21520 (Revised) 04 April 2002.

Dear Mr. Stanley,

I would like to give comments related to the above public notice.

- I interpret that the above referenced notice that the estimated acreage of the jurisdictional wetlands has been substantially revised. Other sites considered by the USACE, including Spillman's Island and Shoal Point, involve fewer acres of jurisdictional wetlands. EPA's 404(b)(1) guidelines call for the denial of the requested permit when other sites require less filling of jurisdictional wetlands. **I recommend denial of the permit for the Bayport location since these guidelines are consistent with the spirit and intent of NEPA policy.** A detailed analysis of the Spillman Island and Shoal Point alternatives should be reconsidered in light of this change in wetland jurisdictional acreage. 23-123 14-74
- Since the total acreage of the wetlands on the Bayport site has been changed from the original DEIS **the DEIS should be reopened for six weeks to allow time to amend our comments on the original DEIS.** 14-75
- Since the noise barrier has been changed in this public notice, **the period for submitting comments on the DEIS should be reopened to receive comments on the noise barrier change and related impacts.** 23-194
- The safety of having a container facility so close to a heavily populated area should be reviewed, especially in light of the 9/11 terrorists attacks on America and Americans. The sources cited by Bo McDaniel, city manager of the city of Seabrook, in his letter to you support the removal of a container facility to a less vulnerable area. At the very least **this matter should be subjected to public interest review as called for in 33 CFR 320.4, including a call for review and comment by the Homeland Security Advisory Council.** 21-62 23-187

Because of the substantive changes in the DEIS I request another public hearing.

Sincerely,

Suzanne Decker

MAY 0 1 2002

April 29, 2002

P11804

Helen Burton
2918 Sea Ledge Drive
Seabrook, TX 77586

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Re: Public Notice per Permit Application No. 21520 (Revised) 04 April 2002.

Dear Mr. Stanley,

I would like to give comments related to the above public notice.

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Because of the substantive changes in the DEIS I request another public hearing.

Sincerely,

Helen Burton

Helen Burton

MAY 0 1 2002

April 29, 2002

XP11805

Herman Burton
2918 Sea Ledge Drive
Seabrook, TX 77586

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Re: Public Notice per Permit Application No. 21520 (Revised) 04 April 2002.

Dear Mr. Stanley,

I would like to give comments related to the above public notice.

- I interpret that the above referenced notice that the estimated acreage of the jurisdictional wetlands has been substantially revised. Other sites considered by the USACE, including Spillman's Island and Shoal Point, involve fewer acres of jurisdictional wetlands. EPA's 404(b)(1) guidelines call for the denial of the requested permit when other sites require less filling of jurisdictional wetlands. **I recommend denial of the permit for the Bayport location since these guidelines are consistent with the spirit and intent of NEPA policy.** A detailed analysis of the Spillman Island and Shoal Point alternatives should be reconsidered in light of this change in wetland jurisdictional acreage. 23-123 14-74
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Because of the substantive changes in the DEIS I request another public hearing.

Sincerely,

Herman Burton

Herman Burton

MAY 0 1 2002

April 29, 2002

XP 11806

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Re: Public Notice per Permit Application No. 21520 (Revised) 04 April 2002.

Dear Mr..Stanley,

I would like to give comments related to the above public notice.

- I interpret that the above referenced notice that the estimated acreage of the jurisdictional wetlands has been substantially revised. Other sites considered by the USACE, including Spillman's Island and Shoal Point, involve fewer acres of jurisdictional wetlands. EPA's 404(b)(1) guidelines call for the denial of the requested permit when other sites require less filling of jurisdictional wetlands. **I recommend denial of the permit for the Bayport location since these guidelines are consistent with the spirit and intent of NEPA policy.** A detailed analysis of the Spillman Island and Shoal Point alternatives should be reconsidered in light of this change in wetland jurisdictional acreage. 23-123 14-74
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Because of the substantive changes in the DEIS I request another public hearing.

Sincerely,

Mary McCullen

MAY 0 7 2002

May 6, 2002

XP 11807 ✓

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

While not originated by me, the following summarizes my views and concerns:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).
I request the following actions from the Corps of Engineers:

- The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS). I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91
- The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186
- The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198
- In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23 [illegible] 22-23

Specific comments on the revised permit application are as follows:

- The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 2[illegible]-193
- The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75
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  - Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated.
  - The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13
  - Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13
  - The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 23-216

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Bob Buddingh
4830 Palm Street
Seabrook, Texas 77586

MAY 0 6 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

XP 11808

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

1.0 The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed with the letter to you earlier this year. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS for the revised permit application. 29-91

2.0 The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

3.0 The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198

4.0 In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-196 23-23

Specific comments on the revised permit application are as follows:

5.0 The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 23-193

6.0 The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

7.0 The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since an understanding of these impacts should be provided in the DEIS, the DEIS should be reopened for comments. 22-159

8.0 The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. 3-64

In particular:

- Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated. 3-64
- The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13
- Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13
- The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 23-216

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Bernard Legrand 05_01_02

Bernard Legrand
3115 Layne Court
La Porte Texas, 77571

XP 11809 -
D

Virginia Pierson-Turner
231 Bayside Drive
La Porte, Tx. 77571

(281) 471-8588

May 3, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

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I request the following actions from the Corps of Engineers:

- The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed with the letter to you dated December 12, 2001. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91
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In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 22-99

Thank you for your consideration of this important matter.

Sincerely,

Virginia Pierson-Turner

Jesse H. Jones Graduate School of Management
Rice University

Total number of pages (including cover sheet): 4 If you do not receive all pages, please call (713) 348-3463

FAX Number 409-766-3431 Date 5-3-02 Time Sent

Attention Kerry Stanley

From Sharon Matusik

RE Bayport EIS

XP 11810

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6100 Main Street • Houston, Texas 77251-1892 • (713) 348-3463 • FAX (713) 348-5251

YP 11810

Sharon F. Matusik
3526 Miramar Drive
Shoreacres, TX 77571

May 3, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed in comment form I submitted at the George R. Brown Convention center hearing on December 12, 2001. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91

The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198

In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-196 23-23

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The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

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In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Sharon F. Matusik

Jesse H. Jones Graduate School of Management
Rice University

FAX TRANSMITTAL SHEET

Total number of pages (including cover sheet): 4 If you do not receive all pages, please call (713) 348-[redacted] 6234

FAX Number (409) 766 3931 Date 4/3/02 Time Sent

Attention Mr. Kerry M. Stanley

From Michael B. Heeley

RE Comments on Permit Application # 21520 - revised.

XP 11811

NOTE:

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·6100 Main Street • Houston, Texas 77251-1892 • (713) 348-3463 • FAX (713) 348-5251

XP 11811

Michael B. Heeley
3525 Miramar Drive
Shoreacres, TX 77571

May 1, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

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In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area 29-99

citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people.

Thank you for your consideration of this important matter.

Sincerely,

Michael B. Heeley

MAY 0 6 2002

XP 11812

JOHN C. CARDENAS
114 BAY COLONY DRIVE
LA PORTE, TEXAS 77571
(281) 281-333-2884

May 3, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

* The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed with the letter to you dated March 13, 2002. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91

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In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

John C. Cardenas

MAY 0 6 2002

XP 11813

Eunice Cherry
4703 Hawthorne , St.
Seabrook, Texas 77586
May 3,2002

Kerry M. Stanley
Regulatory Branch, CESWG - PE --RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553 _ 1229

Dear Mr. Stanley,

This letter presents my comments on the Port Of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application number 21520 -revised).

I request the following actions of the Corps of Engineers:

The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/ Cruise Terminal Draft Environmental Impact Statement (DEIS) listed in my latest letter to you dated, March 14, 2002. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91

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I still am opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people 29-99

I would appreciated your further consideration of the important matter.

Respectfully,
Eunice Cherry
Eunice Cherry

XP 11814

203 Bay Colony Circle
La Porte, TX 77571
May 2, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Re: Permit Application Number 22520-revised

Dear Mr. Stanley:

This letter is in response to the recent Permit Revisions regarding the request from the Port of Houston Authority (PHA) to construct a Container Port/Cruise Terminal in the Bayport Channel. We are both retired and our paid-for home is located adjacent to Bayport Channel. We wrote you several letters objecting to the granting of this permit before the March deadline in response to the original Draft Environment Impact Study produced by you late last year.

To begin, let me restate that all my concerns regarding the original permit request still exist, as the DEIS failed to address any of them. They include air, noise and light pollution, endangerment to the wetlands, and danger from hazardous and deadly terrorist cargo aboard un-inspected containers. The revisions do not adequately address any of these concerns. 23-195

The PHA must be forced to **honestly** consider and evaluate alternate sites – particularly Stillman's Island, which has far fewer wetlands than Bayport. The PHA is skewing the evaluation of Stillman's Island by not exploring the north expansion of the site at Barbour's Cut. This is gross deceit on the part of the PHA. Recent new information that the Bayport site contains a much vaster area of wetlands than was originally supposed exacerbates the need for this process. 2--177

As homeowners whose yard abuts the Bayport north shore we can tell you that a 20' concrete wall (which is offered as a noise abatement "solution") is not acceptable for several reasons:

a. the noise will becoming from sources higher than 20'
b. while the noise may be slightly less in a strip immediately beside the wall, the noise will arc and actually **increase** the sound levels within one block and further

3-64

c. such an unsightly wall (no mention of "berms with green plantings, etc." on the north shore) will block our Bay view and our Bay breeze while accomplishing nothing 22-160
d. there is not room for such a wall without disturbing utility poles, the Exxon pipeline, and the rain run-off slues which are now in place in the bulkhead 22-161

The PHA has broken the law by publicly proclaiming to already own all the land described in the Permit Application. They do not. And the City of Seabrook will refuse by law to condemn any property owned by it. 23-196

We would refer the Corps to a recent similar application made by the Port of Charleston and the decision to deny the permit made by the South Carolina State Legislature. The conditions are identical to the Houston PHA Bayport application. In South Carolina, the decision was made to allot those monies to education rather than further lining the pockets of its Port, something the Texas Legislature very well may heed in its deliberations in the upcoming session... 22-162

In conclusion, we are asking you not to destroy our home. Please re-open discussion on this permit request. This deadline of May 4 was unrealistic for adequate citizen response, and even viewed as hostile behavior by the Corps. A full second DEIS must be produced answering the enormous public resistance evidenced to date. 23-197

Very truly yours,

Ginny Garrett

Ginny Garrett

Tom Garrett

Tom Garrett
US Navy, Retired

203 Bay Colony Circle
La Porte, TX 77571
May 2, 2002

Colonel Leonard Waterworth
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Re: Permit Application Number 22520-revised

Dear Col. Waterworth:

This letter is in response to the recent Permit Revisions regarding the request from the Port of Houston Authority (PHA) to construct a Container Port/Cruise Terminal in the Bayport Channel. We are both retired and our paid-for home is located adjacent to Bayport Channel. We wrote you several letters objecting to the granting of this permit before the March deadline in response to the original Draft Environment Impact Study produced by you late last year.

To begin, let me restate that all my concerns regarding the original permit request still exist, as the DEIS failed to address any of them. They include air, noise and light pollution, endangerment to the wetlands, and danger from hazardous and deadly terrorist cargo aboard un-inspected containers. The revisions do not adequately address any of these concerns.

The PHA must be forced to **honestly** consider and evaluate alternate sites – particularly Stillman's Island, which has far fewer wetlands than Bayport. The PHA is skewing the evaluation of Stillman's Island by not exploring the north expansion of the site at Barbour's Cut. This is gross deceit on the part of the PHA. Recent new information that the Bayport site contains a much vaster area of wetlands than was originally supposed exacerbates the need for this process.

As homeowners whose yard abuts the Bayport north shore we can tell you that a 20' concrete wall (which is offered as a noise abatement "solution") is not acceptable for several reasons:

a. the noise will becoming from sources higher than 20'
b. while the noise may be slightly less in a strip immediately beside the wall, the noise will arc and actually **increase** the sound levels within one block and further
c. such an unsightly wall (no mention of "berms with green plantings, etc." on the north shore) will block our Bay view and our Bay breeze while accomplishing nothing
d. there is not room for such a wall without disturbing utility poles, the Exxon pipeline, and the rain run-off slues which are now in place in the bulkhead

The PHA has broken the law by publicly proclaiming to already own all the land described in the Permit Application. They do not. And the City of Seabrook will refuse by law to condemn any property owned by it.

We would refer the Corps to a recent similar application made by the Port of Charleston and the decision to deny the permit made by the South Carolina State Legislature. The conditions are identical to the Houston PHA Bayport application. In South Carolina, the decision was made to allot those monies to education rather than further lining the pockets of its Port, something the Texas Legislature very well may heed in its deliberations in the upcoming session....

In conclusion, we are asking you not to destroy our home. Please re-open discussion on this permit request. This deadline of May 4 was unrealistic for adequate citizen response, and even viewed as hostile behavior by the Corps. A full second DEIS must be produced answering the enormous public resistance evidenced to date.

Very truly yours,

Ginny Garrett

Ginny Garrett

Tom Garrett

Tom Garrett
US Navy, Retired

MAY 0 6 2002

XP 11815

Tracy Revak
214 Shoreacres Blvd.
Shoreacres, TX 77571

May 2, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the U. S. Army Corps of Engineers:

* The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed with the letter to you dated November 14, 2001 and at the George R. Brown Convention Center on December 12, 2001. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91

* The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

* The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198

* In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port 23-196 23-23

does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. Hasn't the Port legally misrepresented their intentions? 23-23

Specific comments on the revised permit application are as follows:

* The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 23-193

* The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

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* The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular: 3-64

- Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated.

- The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. How will the sound wall effect the Houston Yacht Club? 28-13

- Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. I have had water in my home four times in the last 25-13

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two years from high water after heavy rains. What am I to expect if the adjoining wetlands and Boggy Bayou prevent water flow or runoff?

- The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-419

- The impact on the dredging specific to the Oyster Bed will be impacted negatively and should be examined in an updated DEIS. 12-52

- The proximity of the La Porte Independent School District and their outward opposition to the proposed facility due to the air and noise pollution caused by direct/indirect container port operations should be examined in an updated DEIS. 5-35

I strongly believe that the strategy of the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement a practical, logical and unavoidable event. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 23-216

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Tracy Revak

MAY 0 6 2002

XP 11818

May 2, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

- The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed with the letter to you last month. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91

- The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

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In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 23-216

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Sandra Lochner
3512 Bayou Forest Dr.S.
Shoreacres, Tx 77571

M. 2 2002

11817

MARCUS A. LAMKIN

May 1, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

(As you are aware, this program by our citizens group to send you the same letter written by our leaders, may seem like we are being lead by the nose. I would like to assure you however, that the statements herein are every bit mine and that citizens are staying informed as to the methods being used by the bureaucrats of the Corps and the PHA. If it requires a march on the bureaus, we will be there. We feel that strongly about it. Next is the letter.)

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I request the following actions from the Corps of Engineers:

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3412 BAYOU FOREST DRIVE LA PORTE, TEXAS 77571 TELEPHONE 281-471-2130

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Thank you for your consideration of this important matter.

Sincerely,

Marcus Lamkin

Marcus A. Lamkin
Phone & fax 281 471 2130

YP 11818

May 1, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

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I request the following actions from the Corps of Engineers:

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- The impacts of a 20-foot wall on area wildlife must be examined in an updated DEIS. 12-49

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In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Stan and Jane Krauhs
1103 Shoreacres Blvd.
Shoreacres, TX 77571

11819

Stanley, Kerry M SWG

From: Stan and Jane Krauhs [krauhs@wt.net]
Sent: Wednesday, May 01, 2002 9:58 PM
To: Kerry M. Stanley
Subject: Comments on the PHA's Bayport Channel Container/Cruise Terminal revised permit application Application Number 21520-revised)

Mr. Stanley,

Please find my comments below on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised). They are also attached as an MSWord document for your convenience.

Copy of 11818

May 1, 2002

Kerry M. Stanley

Regulatory Branch, CESWG-PE-RE

U.S. Army Corps of Engineers

P.O. Box 1229

Galveston, Texas 77553-1229

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11819

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Sincerely,

Stan and Jane Krauhs

1103 Shoreacres Blvd.

Shoreacres, TX 77571

XP 11820

MAY 0 6 2002

Mr. & Mrs. W. B. Thomas
4727 Geraldine
Seabrook, TX 77586

May 1, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

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Mr. & Mrs. W. B. Thomas
4727 Geraldine
Seabrook, TX 77586

11820

* The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guide lines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 23-193

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* The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since an understanding of these impacts should be provided in the DEIS, the DEIS should be reopened for comments. 22-159

* The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular: 3-64

- Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated.

- The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13

- Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13

- The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 23-216

Mr. & Mrs. W. B. Thomas
4727 Geraldine
Seabrook, TX 77586

11820

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Charlene Thomas

XR 11821

MAY 0 6 2002

May 1, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

On behalf of the El Jardin Community Association, as their appointed representative on the Port of Houston Citizen Advisory Panel, I wish to submit the following comments regarding the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

- The revisions in the permit application still do not reflect any changes that would make this project acceptable to the residents of El Jardin Del Mar. We remain opposed to the project and view the issuance of a permit for this facility to be the total destruction of our property values and quality of life. 29-100

- The comment period is inadequate for citizens to review and comment on, and additional time should be granted. The comment period should be extended 60 days. 23-198

- The original application submitted by the Port of Houston made assurances that all land was owned by the PHA. This is not a true statement. The PHA is actively involved in aggressive action to take land from citizens and from local businesses against their will. When there are viable, alternative sites available for this project, it is an outrage that private property will aggressively be condemned and taken. 23-196

- The DEIS' for the proposed container facilities at Bayport and Texas City both were processed through the Galveston Corps office. Experts were hired and their data should have been without flaw. Due to the serious discrepancies in wetland numbers between the two projects, I think it is clear that the experts have no idea what they are doing. Since I was a member of the Port of Houston Citizen Advisory Panel, I listened to many hours of their expert meanderings, and after reading their final reports, it is clear to me that their reports are not based on scientific fact, but on "expert" speculation. 23-206

- According to the DEIS, Real Estate Values are supposed to rise. However, no data was presented. In fact, the DEIS states that more information would be 6-

available on the final EIS. This is unacceptable. We want the data now to study it, because if it is like what we have already seen there will be gross errors and omissions. In addition, there was no community represented in the real estate report that was comparable to El Jardin. Communities selected for the report were handpicked, water front homes, that are not visually near the Barbour's Cut terminal. A real indicator of property values was reported in the Houston Chronicle in April which listed La Porte as some of the lowest sq. ft. value in all of Harris County. This is the kind of data that is relevant and should have been shown to illustrate that a container facility adjacent to a neighborhood is going to kill it as surely as Barbour's Cut destroyed the La Porte neighborhood it was built beside. 6-139 6-140

- There is sufficient data that indicates that the sound walls will be totally ineffective as the sound will travel over the wall. Modeling which studies the effect of sound traveling over the wall and into the neighborhoods should be done. 3-64

In conclusion, it is clear that there are many issues which were inadequately or incorrectly addressed in the EIS, therefore a Supplemental EIS should be conducted to address these problems.

For the record, I would like to add that Colonels and Project Managers have come and gone at the Corps office since this permit was submitted by the PHA. However, the citizens have remained steadfast through it all. We did not originally oppose this project outright, however we were infuriated by the aggressive, arrogant behavior portrayed by the PHA representatives to our community. We have waited for years to read the scientific data regarding the impacts of this project on our community and the bay area. If the ACE grants this permit, based on the data presented in the DEIS, it is clearly against the intent of NEPA. There are practicable alternatives to Bayport, however, I suspect that matters little to the Corps in your pursuit to facilitate the permitee, the PHA. 23-207

The residents of El Jardin feel the Bayport data presented is flawed and directly contradicts data presented in the Texas City DEIS. We were never opposed to building a container facility in theory, but we questioned it's location. The residents of El Jardin Del Mar remain completely opposed to this project as data has come forward regarding the impacts, we are not pacified, we are only more enraged. 29-101

Respectfully submitted,

Charlotte Cherry

Charlotte Cherry
El Jardin Del Mar Community Association
4902 Elm Street
Seabrook, Texas 77586

Marie D. Wise

1129 E. 16th Street
Houston, Texas 77009
home 713.426.3170
cellular 713.419.5329
marie.wise@mindspring.com

MAY 0 6 2002

XP 11822

May 1, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

- The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed with the letter to you dated March 9, 2002. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91
- The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186
- The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198
- In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-196 23-23

Specific comments on the revised permit application are as follows:
The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 23-193

The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since an understanding of these impacts should be provided in the DEIS, the DEIS should be reopened for comments. 22-159

The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular: 3-64

- Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated.
- The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13
- Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13
- The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 23-216

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Marie D. Wise

XP11823

MAY 0 8 2002

R. Alan Parrish
5555 SAN FELIPE - SUITE 1650
HOUSTON, TEXAS 77007
Phone: (713) 439-7000

R. ALAN PARRISH
aparrish@broadreachltd.com

May 1, 2002

Mr. Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston s Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

- The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

- The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-148

- In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-196 23-23

Specific comments on the revised permit application are as follows:

- The Corps of Engineers should not issue a permit for Bayport. The

Environmental Protection Agency s 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman s Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 23-193

- The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

- The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since an understanding of these impacts should be provided in the DEIS, the DEIS should be reopened for comments. 22-159

- The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular: 3-64

- Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated.

- The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13

- Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13

- The impacts of a 20-foot concrete wall on area wildlife must be examined in an updated DEIS. 12-29

Combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a 23-216

MAY 0 5 2002

VP 11824

May 1, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my further comments on the Port of Houston's Bayport Channel Container/Cruise Terminal because of the revised permit application (Permit Application Number 21520-revised).

I am requesting the following actions from the Corps of Engineers:

- The revised permit application requests changes in the project that were not included in the DEIS. Please revise the DEIS to be consistent with the revised permit application and reopen for public comment. 23-186
- Extend the comment period to allow us to understand these changes. 23-198
- Alternative sites have not been fully examined. If this were done the Corps would find out that in nearly every way possible these sites are less detrimental to the environment and are more practical. Shoal Point and Spillman Island have been nearly ignored. 23-193
- The total number of acres of wetlands and the total number of jurisdictional wetlands have been changed from the DEIS. to the revised permit application. Thus, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75
- The total number of acres of open bay water and the total number of jurisdictional open bay water acres have also been changed. Again, the DEIS should be reopened for comments. 22-159
- The PHA has recently purchased an 8.77 Acre tract of land in Seabrook. It is obvious they are attempting to comply, AFTER THE FACT, with the requirement that they own all the land included in their permit application. They are attempting to purchase additional tracts now, but they are legally too late for the Corps of Engineers to issue the permit as requested. 23-205
- The rail line shown in the permit is illegal because the PHA does not have the right of eminent domain. It cannot put rail in the city of Seabrook. 22-164

It is obvious that now a Supplemental Draft EIS is required. There are too many flaws, incorrect statements, and changes for the Corps of Engineers to deny this request. 23-216

Thank you for considering my comments.

Sincerely,

Rosebud L. Caradec
1350 Nasa Pkwy, #118
Houston TX 77058-3165

MAY 0 1 2002

Kay L. Snider
202 Bay Colony Drive
La Porte, TX 77571-7308

XP 11825

April 30, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

- The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed with the letter to you dated February 18, 2002. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91

- The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

- The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198

- In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-146 23-23

Specific comments on the revised permit application are as follows:

- The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 23-193

- The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

- The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since an understanding of these impacts should be provided in the DEIS, the DEIS should be reopened for comments. 22-159

- The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular: 3-64

  - Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated.

  - The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13

  - Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13

  - The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be 23-216

11825 MAY 0 1 2002

afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS.

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Very truly yours,

Wayne L. Snider

MAY 0 1 2002

XF 11826

April 30, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised
permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

* The revisions in the permit application do not change any of the concerns documented in my previous
comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement
(DEIS) conveyed with the letter sent to you previously. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91

* The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

* The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198

* In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-196 23-23

Specific comments on the revised permit application are as follows:

* The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of 23-193

wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives.

* The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

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* The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular: 3-64

- Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated.

- The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13

- Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-8

- The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions
of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 23-216

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Daniel Henn

(DANIEL HENN)

MAY 0 6 2002

April 30, 2002

MAY 0 6 2002

XP 11827

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas, 77553-1229

Dear Mr. Stanley,

This letter presents our comments on the Port of Houston's Bayport Channel/Cruise Terminal revised permit application (Permit Application number 21520 revised).

I request the following actions from the Corps of Engineers:

The revisions in the permit application do not change any of the concerns documented in our previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed in our earlier letter. We remain opposed to the project and feel strongly that it is the wrong project in the wrong place at the wrong time. Please note the article from the Houston Chronicle's Business Section dated April 16, 2002. The Port is looking to building a facility that is in effect a "dinosaur", outdated to the point of becoming an albatross around its neck before completion. By this letter please incorporate our comments on the DEIS into these comments on the revised permit application. 29-91

The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198

In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The corps should require the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-196 23-23

Specific comments on the revised permit application are as follows:

The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1)a guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 23-193

The total number of acres of wetlands and the total number of jurisdictional wetlands were changes from the DEIS to the revised permit application. Since impact on wetlands is also an important issure in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since and understanding of these impacts should be provided in the DEIS, the DEIS should be reopened for comments. 22-159

The proposed noise mitigation for the project was changed from the DEIS to the revise permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular:

Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated. 3-64

The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. Not only will it be an eyesore it will block all prevailing sea breezes and views of the water. 28-13

Some of Shoreacres and south LaPorte drain into the Bayport channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13

The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to Correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, 23-216

We remain opposed to the Bayport site for a new container terminal. The Bayport alternative would create unavoidable and unacceptable negative impact to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts for fewer people.

29-91

Thank you for your considerations of this important matter.

Sincerely

Dwight + Carol-Lee Hollister

Dwight and Carol-Lee Hollister
206 Bay Colony Dr.
La Porte, TX 77571
281-867-5068
cdhollister@aol.com

cc: Texas Natural Resource Conservation Commission
401 Coordinator
MSC-150
P.O. Box 13087
Austin, Texas 78711-3087

MAY 0 6 2002

MARK TRUSTY
215 Bay Colony Circle
La Porte, Texas 77571
Phone: 281-470-0365
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markt1967@aol.com

VP 11823

April 30, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U. S. Army Corp of Engineers
P. O. Box 1229
Galveston, Texas 77553

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Container/Cruise Terminal revised permit application #215520.

I request that the Corp of Engineers reopen the comment period on the DEIS with these new revision in place, followed by a Supplemental DEIS based on the revisions. The public deserves the right for the additional review and comment period. But believe that none of this should happened until the Port of Houston has ownership of all of the land needed for the project. 23-198

- In the revised permit application, the Port of Houston has misrepresented (which is now common place for the Port) its ownership of the land needed for the project. the Port does not own all of the land included in the project design represented in the revised permit application., the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corp should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-196 23-23

- The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since and understanding of these impacts should be provided in the DEIS, and DEIS should be reopened for comment. 20-159

- The total number of acres of wetlands and the total number of jurisdictional wetlands were changed (which seems to be common place with the Port) from the DEIS to the revised permit application. The Corp of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corp deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoals Point and Spillman's island, that require fewer acres of wetlands. These alternatives are clearly practicable, as they were included in the DEIS as final, feasible alternatives. 14-75 23-193

- The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to me and the adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated. The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in and updated DEIS. The impact of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. Last, but not least the impacs of a concrete barrier on the drainage and flooding in the area must be examined extensively in an updated DEIS. 3-64 28-13 12-49 25-13

The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport project DEIS conveyed with the letter to you dated March 4, 2002. i remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. Now, combining the flaws and the omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS. 29-91 23-216

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Sincerely,

Mark Trusty

MAY 0 2 2002

Dean Snider
202 Bay Colony Drive
La Porte, TX 77571-7308

YP118239

April 30, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Stanley:

This letter presents my comments on the Port of Houston's Bayport Channel Container/Cruise Terminal revised permit application (Permit Application Number 21520-revised).

I request the following actions from the Corps of Engineers:

- The revisions in the permit application do not change any of the concerns documented in my previous comments on the Port of Houston's Bayport Channel/Cruise Terminal Draft Environmental Impact Statement (DEIS) conveyed with the letter to you dated February 18, 2002. I remain opposed to the project. By this letter, please incorporate my comments on the DEIS into these comments on the revised permit application. 29-91

- The revised permit application requests changes in the project that were not included in the DEIS, such as the north side sound wall and the additional outfall into Pine Gully. Therefore, the DEIS should be revised to be consistent with the revised permit application and reopened for public comment. 23-186

- The comment period for the revised permit application must be extended at least 60 days. Area citizens have not had adequate time to understand the changes to the permit application and, more importantly, have not had adequate time to understand the implications of those changes. 23-198

- In the revised permit application, the Port of Houston continues to misrepresent its ownership of the land needed for the facility. The Port does not own all of the land included in the facility design represented in the revised permit application, the owners of these properties do not intend to willingly sell, and the Port does not have the authority to condemn the properties. The Corps should require that the Port of Houston withdraw its permit application and not be allowed to re-file until they have complied with all applicable rules and laws. 23-196 23-23

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Specific comments on the revised permit application are as follows:

- The Corps of Engineers should not issue a permit for Bayport. The Environmental Protection Agency's 401(b)(1) guidelines require that the Corps deny the permit if there are practicable alternatives that require filling fewer acres of jurisdictional wetlands. The DEIS includes alternatives, including Shoal Point and Spillman's Island, that require filling fewer acres of wetlands. These alternatives are clearly practicable, or they would not have been included in the DEIS as final, feasible alternatives. 23-193

- The total number of acres of wetlands and the total number of jurisdictional wetlands were changed from the DEIS to the revised permit application. Since impact on wetlands is also an important issue in the DEIS, the DEIS should be reopened for comments to allow the public to amend its comments on the DEIS. 14-75

- The total number of acres of open bay water and the total number of jurisdictional open bay water were changed from the DEIS to the revised permit application. Again, since an understanding of these impacts should be provided in the DEIS, the DEIS should be reopened for comments. 22-159

- The proposed noise mitigation for the project was changed from the DEIS to the revised permit application. Noise impacts are a particular concern to adjacent communities and residents must be afforded the opportunity to update their comments on the DEIS to reflect these changes. In particular: 3-64

  - Concrete noise walls can actually increase noise impacts in areas more than a few blocks from the walls as the noise profile is altered and concentrated.

  - The addition of the noise wall changes the aesthetics analysis in the DEIS. The impacts of a concrete wall on aesthetics must be examined in an updated DEIS. 28-13

  - Some of Shoreacres and south La Porte drain into the Bayport Channel via Boggy Bayou and numerous outflows along the north bank. The impacts of a concrete barrier on drainage and flooding in the area must be examined in an updated DEIS. 25-13

  - The impacts of a 20 foot concrete wall on area wildlife must be examined in an updated DEIS. 12-49

In my previous comments, I asked the Corps of Engineers to correct and complete the DEIS impact analysis with a Supplemental Draft Environmental Impact Statement. Now, combining the flaws and omissions of the DEIS with the changes made in the revised permit application, the changes are clearly far too extensive to proceed to the Final EIS. The public deserves the right for the additional review and comment that would be 23-216

11829 MAY 0 2 2002

afforded first by reopening the comment period on the DEIS, followed by a Supplemental DEIS.

In summary, I remain opposed to the Bayport site for a new container terminal. The Bayport Alternative would create unavoidable and unacceptable negative impacts to area citizens and should be rejected. It is clear that other alternatives would pose fewer negative impacts to far fewer people. 29-99

Thank you for your consideration of this important matter.

Very truly yours,

BLACKBURN CARTER
A Professional Corporation
Lawyers

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MAY 3 2002

May 2, 2002

XP-11842

Federal Express and
Via Facsimile: (409) 766-3931
Mr. Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U.S. Army Corps of Engineers
2000 Fort Point Rd.
Galveston, Texas 77553

RE: Comments to Public Notice for Permit Application 21520 (Revised) issued April 4, 2002

Dear Mr. Stanley:

In response to the Public Notice issued on April 4, 2002 soliciting comments on Permit Application 21520 (Revised) by the Port of Houston Authority (POHA), the Galveston Bay Conservation and Preservation Association (GBCPA) hereby submits its comments to the revised application as described in the Public Notice. **GBCPA HAS BEEN AND CONTINUES TO BE OPPOSED TO THE ISSUANCE OF THIS PERMIT**. GBCPA incorporates into its comments herein all comments, attachments, and submissions previously made by GBCPA to the DEIS for the Bayport project that was published by the Corps on November 12, 2001. GBCPA has attached herein two sections of their prior comments and a study for the Texas City project for the ease of the reviewer. GBCPA assumes that the DEIS for Bayport and the DEIS for Texas City (Shoal Point) included in our comments on the Bayport DEIS are part of this administrative record.

I. Failure to Extend/Re-open Comment Period on DEIS

GBCPA objects to the Corps' failure to extend the comment period on the DEIS. The Bayport project which was evaluated in the DEIS has been revised by the applicant as outlined in the Public Notice issued April 4, 2002. GBCPA believes that a Supplemental DEIS to evaluate the changed project, with the opportunity for public comment, should be required. At the very least, GBPCA and others should be given the opportunity to modify and/or supplement the previously submitted comments to the DEIS in light of the revised project.

The changes in the proposed action are significant. The number, location and extent of both total and jurisdictional wetlands that were identified in the DEIS have been changed by the Corps, purportedly based on new information, as outlined in the Public Notice issued April 4, 2002. The analysis of alternatives in the DEIS should be re-evaluated regarding the impacts to jurisdictional wetlands, with the opportunity for public comment. The mitigation features as proposed by the applicant (POHA) are no longer valid as to wetlands, given the increased number now identified by the Corps to be jurisdictional! Further, the number of acres of open-

Incorporate & revise in 23-6

11842

water habitat that were identified in the DEIS have been changed by the Corps, based on new information, as outlined in the Public Notice issued April 4, 2002. Again, a Supplemental DEIS is required to properly identify this new information and the location of the revised acreage of open water habitat, and re-evaluate the impacts to this habitat, with the opportunity for public comment, or at the very least the opportunity to revise and/or supplement previously submitted comments to the DEIS in light of the changes in the acreage of open-water habitat. Further, the proposed project has been altered to include noise mitigation that was not disclosed or evaluated in the DEIS. The issue of noise impacts should also be re-evaluated or, at the least, GBCPA and others should be given the opportunity to review their analysis and resubmit comments.

Incorporate & Revise in 23-6

3-62

The following are specific changes to the proposed action that require the DEIS to be either supplemented or require the comment period to be re-opened.

A. Wetlands

The Revised Public Notice states that 114.5 acres of non-jurisdictional wetlands exist within the proposed project site. When added to the newly established 18.3 acres of jurisdictional wetlands that has been identified by the Corps in the Public Notice, the total acreage of wetlands, according to the Corps, is now 132.8 acres, as compared to approximately 100 acres that the Corps had previously determined for this site, as stated in the DEIS. The Public Notice fails to identify where these 132.8 acres of wetlands are located on the project site, and where (and how) the additional acreage was delineated, thereby preventing the public from being able to fully comment on the appropriateness or accuracy of this delineation. According to Dr. Jacob's report attached hereto, GBCPA contends there are significantly more than 132 acres of total wetlands on the proposed Bayport project site, many of which are jurisdictional, as discussed in other sections of these comments.

14-86

B. Mitigation Features

The Public Notice issued April 4, 2002 includes on Sheet 24 of 28 through Sheet 28 of 28 a write-up on the mitigation features being proposed by the applicant for the proposed Bayport project. This write-up, with a date of October 11, 2001, was obviously prepared prior to the release of the DEIS and prior to the revisions identified in the Public Notice, and therefore, is clearly inadequate. For example, the wetland mitigation section includes a proposal by the applicant to create 12.38 acres of jurisdictional wetlands, contending this will produce a ratio of 5:1 compensation for lost jurisdictional wetlands. However, this is based on the 2.5 acres of jurisdictional wetlands originally identified by the Corps in its DEIS, not the 18.3 acres now identified by the Corps per the Public Notice issued April 4, 2002. This is why a Supplemental DEIS is necessary, so that there is no confusion as to what is the current project proposal, what are the current conditions on the project site, and what are the anticipated impacts from the current project proposal on the current conditions on the site. If the applicant and the Corps cannot keep it straight, the Corps cannot expect the public to be able to know what is going to happen and be able to provide comments on it.

14-87

C. Open Water Habitat

The Public Notice identifies approximately 310 acres of open water habitat existing within the project site that is jurisdictional, of which 23.5 acres would be impacted by the construction of the bulkhead/wharves for the cruise terminal. Unfortunately, the Corps fails to identify either the location of the open-water habitat acreage or the location of the impacted acreage in order for the public to fully comment on or evaluate this issue. 14-88

D. Noise Buffers

The DEIS that was published by the Corps on November 12, 2001 evaluated the Bayport project as then proposed by the POHA. The public furnished comments to that DEIS based on that project proposal. The Public Notice issued April 4, 2002 identifies various revisions made by the POHA to the proposed Bayport project in order to provide additional buffering for noise, including the relocation of a proposed berm and the construction of a concrete wall, in addition to pine trees. These modifications to the Bayport project by the applicant were clearly in response to comments made by local residents and GBCPA regarding the anticipated noise impact to the local residents from the construction/operation of the Bayport project as originally proposed by the POHA. These changes to the original Bayport project must be evaluated in a Supplemental DEIS to determine their impact to the surrounding communities and whether these changes are sufficient in mitigating these noise impacts some of which were previously identified by GBCPA's expert, who conducted noise modeling for the original project description. **More importantly, these changes to the original project proposal render the modeling submitted by GBCPA in comments to the DEIS to be erroneous because the proposed action upon which this modeling was based has been altered**. Such an alteration to the proposed action, after the close of the comment period, is patently unfair if the public is not given the opportunity to revise its comments to the DEIS based on the altered project. 3-62

E. Alternatives Analysis

The DEIS published by the Corps on November 12, 2001 for the original Bayport project description included not only an evaluation of this Bayport project proposal but an evaluation of other alternative sites at which to locate the proposed container/cruise terminal complex, in order to compare and contrast these various alternatives so that the least damaging practicable alternative could be identified. With the various changes noted above that have been stated in the Public Notice issued on April 4, 2002 for the Bayport project, the alternatives analysis presented in the DEIS is no longer valid. For example, with the change in the number of total and jurisdictional wetlands now established by the Corps to be present at the Bayport project site, this site no longer has the least number of wetlands that would be impacted by the proposed project, as compared to the other alternative sites, as was shown in the DEIS. Such a change necessitates a Supplemental DEIS be prepared by the Corps so that all alternative sites can be fully and fairly evaluated and compared with the Bayport project site, with the public being given the opportunity to review and comment on this Supplemental DEIS, as required by law. 2-176

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F. Full and Fair Disclosure Mandates a Supplemental DEIS

The National Environmental Policy Act (NEPA) was enacted to establish a national policy that favors protecting and promoting environmental quality. In order to achieve this policy, NEPA requires federal agencies like the Corps to follow certain procedures as set out in the statute. One of these requirements is that an EIS be prepared for all major Federal actions significantly affecting the human environment. The Corps correctly decided that this proposed Bayport project, if it were to receive a permit from the Corps, would significantly affect the human environment and therefore prepared a Draft EIS. However, one of the purposes of the EIS is to provide the public with information and serve as an "environmental full disclosure so that the public can weigh a project's benefits against its environmental costs."

The public has reviewed and commented on the Draft EIS that was prepared by the Corps for the Bayport project as originally proposed by the POHA. The comment period on this DEIS ended on March 13, 2002. After the close of the comment period, the applicant (POHA) has revised its Bayport project proposal, in light of some of the comments received from the public. The Corps has also revised some of its determinations contained in the DEIS with regards to wetlands and open-water habitat, purportedly based on new information, but no doubt in response to comments received from the public.

Incorporate & revise in 23-6

These changes, both to the project description and to the environmental conditions at the proposed project site, need to be fully disclosed and evaluated in accordance with NEPA in a Supplemental DEIS. Mentioning them in a Public Notice, as the Corps has done, is inadequate to provide the public with the information they need to fully and fairly evaluate this project. Why the Corps is "rushing" this Bayport project through the process is unclear, but it is clear that the Corps is proceeding forward too hastily and carelessly. How else can one explain the Corps including within the Public Notice a write-up on Mitigation Features dated October 11, 2001 that contains a discussion on wetland mitigation referencing a Corps delineation of 2.5 acres of jurisdictional wetlands while at the same time the Public Notice presents the Corps' new delineation of 18.3 acres of jurisdictional wetlands. Such confusing and conflicting information within the Public Notice does not provide the public with full and fair disclosure as mandated by NEPA.

14-87

Additionally, stating in the Public Notice that the Corps has now determined there are more wetlands than they had previously identified to be on the proposed Bayport project site, without showing where these wetlands are located or how the Corps came to learn of these additional wetlands, falls short of full and fair disclosure.

It is extremely disturbing to see the Corps conduct its duties and obligations in such a manner on this Bayport project. NEPA does not mandate a particular outcome, but it at least requires federal agencies like the Corps to follow a process of full and fair disclosure. The Public Notice does neither.

Certain comments submitted by GBCPA in response to the DEIS, including the noise analysis, have been rendered erroneous as a result of the changes. In our DEIS comments, we modeled the action as proposed and evaluated in the DEIS. Now, before a final EIS, the proposal is changed. That is patently unfair, manipulative and legally and morally wrong. 3-62

II. 404(b)(1) Analysis

According to the rules of the Corps of Engineers, no section 404 permit may be issued without the Corps determining compliance with the EPA 404(b)(1) guidelines. These 404(b)(1) guidelines relate primarily to the protection of wetlands and to the analysis and selection of alternatives. GBCPA is of the opinion that the Bayport site must be rejected if a proper analysis is followed pursuant to the 404(b)(1) guidelines. This is particularly true in light of the new wetland delineation that has been set out in the revised public notice.

With regard to the application of the 404(b)(1) guidelines, several issues exist with regard to the revised public notice. The first is the extent of the jurisdictional wetlands. The second is the actual application of the 404(b)(1) guidelines.

A. Jurisdictional Wetlands

The initial problem with the wetlands analysis in the Bayport Public Notice is that it incorrectly analyzes the extent of jurisdictional wetlands. The Public Notice identifies that only 18.3 acres of jurisdictional wetlands are impacted by this permit application. GBCPA disagrees with this determination and urges that at least 40 acres of jurisdictional wetlands exist on site and will be impacted by the proposed Bayport container facility. 14-86

There is no dispute that substantial wetland acreage exists on the site proposed for the Bayport container facility. Various consultants and methodologies have determined that at least 100 acres of wetlands exist on the site. The DEIS identifies 106 acres utilizing an aerial photographic interpretation process. Work completed for the Bayport Master Plan by Lockwood Andrews and Newnam identifies approximately 209 acres of wetlands at the site and a field determination by Berg-Oliver (wetland consultants) in 1998 found approximately 118 acres of wetlands, both of which did not include the Sereau Tract in the analysis. The National Wetlands Inventory identifies at least 120 acres of wetlands on the site. And now the Revised Public Notice identifies 132 acres of wetlands on the site (18.3 jurisdictional, 114 non-jurisdictional). 14-89

The issue is – which, if any, of these wetlands are jurisdictional? GBCPA has carefully read and considered the U.S. Supreme Court case styled *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (hereinafter called the SWNCC decision). GBCPA is of the opinion that the SWNCC decision does not rule out isolated wetlands as being jurisdictional. Indeed, SWNCC only held that migratory birds alone are not enough to confer jurisdiction on wetlands that are "isolated". In these comments, however, GBCPA is not arguing that the Corps should regulate the wetlands on the Bayport tract as "isolated" wetlands. Instead, GBCPA is arguing that many of the wetlands on the Bayport tract are "adjacent" wetlands as that 14-90

term is used in the Corps regulatory jargon. The Corps clearly agrees with this interpretation by altering their interpretation and delineation of jurisdictional wetlands in the Revised Public Notice from that set out in the DEIS. 14-90

According to the DEIS, which is the best source of information regarding the methodology used by the Galveston District to determine jurisdiction, there are several ways for wetlands to be considered adjacent. If a wetland is in the 100-year flood plain of a water of the United States, then it is considered jurisdictional (DEIS, p. 3.19-2). If a wetland is connected to waters of the United States, then it is considered jurisdictional. This connection can be by surface water tributary or by ditch. (DEIS, p. 3.19-3). At the Bayport site, there are many acres of wetlands that are jurisdictional either due to these wetlands being in the 100 year flood plain or because they are connected to Pine Gully by ditches. Additionally, some wetlands through the Sereau tract may be directly connected to Galveston Bay.

Same as 14-50

GBCPA hired Dr. John Jacob to review the wetland issue and to write a report on his findings. This report is included as an Attachment to these comments. Dr. Jacob is of the opinion that significantly more wetlands are jurisdictional than the 18.3 acres identified in the revised public notice.

First, there are wetlands located within the 100-year flood plain. Dr. Jacob used a Geographic Information System to overlay the FEMA 100 year flood plain with the wetlands that were identified in various surveys at the site. If the analysis of wetlands in the DEIS is overlaid with the 100 year flood plain from the Federal Emergency Management Agency (FEMA), the overlap between these two maps indicates that 8.8 acres of wetlands are jurisdictional (see figure 8 of the attached Jacob report). If the wetlands analysis from the LAN survey is overlaid with the 100-year flood plain, 22 acres of wetlands are jurisdictional (see figure 9 of the Jacob report attached hereto), including a small acreage in the 100-year flood plain of Pine Gully in the southern portion of the site. If the Berg-Oliver wetlands are overlaid with the 100-year flood plain, 5.5 acres of wetlands are jurisdictional (see figure 10 of attached Jacob report).

Second, many wetland areas in the central and south-central portion of the site are connected to Pine Gully by a series of ditches. These ditches were constructed in the early 1990s and are clear and obvious on aerial photos from the mid-1990s to today. Dr. Jacob's interpretation of the ditch system at the site is shown in figure 15. The overlap with wetlands at the site as shown in the Bayport DEIS is shown in figure 18, in figure 20 for the wetlands identified in the LAN study and in figure 22 for the wetlands identified in the Berg-Oliver field survey. As shown in figure 17, the United States Geological Survey (USGS) has included these ditches on its topographic map for League City that was revised in 1995.

As stated in the attached expert report from Lawrence G. Dunbar, a registered professional engineer and hydrologist, the inclusion of drainage ditches on the USGS map is determinative of their status as important physical features.

When the USGS ditch system is overlaid with the wetland system on the proposed Bayport container port site, substantial additional wetland acreage becomes jurisdictional. As shown on figure 19, when the ditch system on the USGS map is overlaid with the wetlands mapped in the DEIS, 14 acres of wetlands are directly connected to that ditch system. As shown in figure 21, when the LAN wetlands are overlaid with the USGS map ditches, 54 acres of wetlands are directly connected to that ditch. As shown in figure 23, when the ditch system is on the USGS map is overlaid with the wetlands mapped on the detailed Berg-Oliver delineation, 41 acres of wetlands are directly connected to that ditch system. At the very least, GBCPA urges that 40 acres of wetlands must be considered jurisdictional because of their connection to waters of the United States by a ditch system represented in the DEIS.

Same as 14-50

In short, by at least two different methodologies, the reach of the jurisdictional wetlands have been shown to be much greater than described by the Corps of Engineers in their analysis in the DEIS. The analysis in the DEIS is deficient and must be redone. GBCPA submits that the true acreage of jurisdictional wetlands must be determined and disclosed.

Same as 14-50

GBCPA also is concerned about discrepancies regarding wetland acreage and analysis between the Bayport DEIS and the Shoal Point DEIS, particularly as those discrepancies relate to the analysis of alternatives discussed below. Dr. Jacob's report identifies a major discrepancy between the two documents. In the Shoal Point DEIS, both the Bayport and Spillman Island sites were evaluated in the alternatives section. A huge difference is indicated in the total wetland acreage impacted at each site. Here, the Bayport DEIS identifies that 207 acres would be impacted at Spillman's Island and 142 acres would be impacted at Shoal Point whereas the Shoal Point DEIS identifies that only 3 wetland acres would be impacted at Spillman's Island and 13 acres at Shoal Point. Apparently, the Galveston District in the Bayport DEIS concluded that the spoil disposal areas at Spillman's Island and Shoal Point were wetlands whereas the Galveston District in the Shoal Point DEIS concluded that the spoil disposal areas at Spillman's Island and Shoal Point were not wetlands. Corps guidance has always determined that active spoil disposal areas are not wetlands. By identifying such large wetland acreage at the two alternative sites, the Bayport DEIS has intentionally made the alternative sites look worse than the Bayport site from a wetlands perspective when that, in fact, is not true.

Same as 14-51

Same as 14-51

According to Dr. Jacob, the wetlands on the site of the proposed Bayport container facility are quite good, even though an attempt was made to drain these wetlands. These are naturally occurring, pimple mound wetlands that Dr. Jacob considers to be of regional significance. Consider the following statements from Dr. Jacob's report:

> The prairie pothole pimple mound complex represents an irreplaceable geologic legacy that is becoming increasingly rare. Because the few remaining pothole complexes are found mainly in urban fringe areas, such as at the Bayport site, they are the most endangered of all wetland types on the Gulf Coast.

Add to 14-54

The Bayport wetland complex is one of the last few large prairie pothole complexes of significant extent on the Upper Gulf Coast of Texas. The extent of this complex is important; there are few complexes left that are large enough to be a functioning ecosystem. (Jacob report, Appendix on Uniqueness).

same as 14-54

B. 404(b)(1) Alternatives Analysis

Under the regulations of the Corps of Engineers, no §404 permit may be issued by the Corps unless that permit meets the requirements of the 404(b)(1) guidelines. 40 CFR 230.10 contains the restrictions on discharge under the 404(b)(1) guidelines. GBCPA submits that an unbiased analysis of alternatives under the criteria of the 404(b)(1) guidelines will lead to the rejection of the Bayport site for failure to conform to the requirements of the 404(b)(1) guidelines.

1. 40 CFR 230.10(a)

40 CFR 230.10(a) states that no discharge of dredge or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. GBCPA submits that practicable alternative sites exist to Bayport that have less adverse impact on the aquatic ecosystem.

same as 2-29 2-155

a. Smaller "Footprint" Defines Practicable Alternative

There are several levels to GBCPA's assertion that less damaging alternatives exist. First, GBCPA references the Shoal Point DEIS (incorporated herein for all purposes). In the Shoal Point DEIS and in the GBCPA alternative analysis by Dr. Ledvina (included herein as an attachment), a different site layout is proposed, one that takes up less land area while providing approximately the same container throughput. In other words, the same amount of commerce flows through a site with a smaller "footprint".

same as 2-154

This smaller "footprint" is important because it minimizes the impact of container facility development at both the Bayport site and at alternative sites. This, in turn, has a direct bearing on the analysis of alternatives under 404(b)(1). For example, as shown in Table 1 on Dr. Jacob's report, the Bayport DEIS identifies Bayport impacting a total of 104 acres of wetlands whereas the Shoal Point DEIS identifies Bayport as impacting only 38 acres of wetlands. Stated otherwise, the Shoal Point and GBCPA smaller footprint alternative is less damaging to the aquatic environment than is the alternative set out in the Bayport DEIS.

same as 2-154

A literal reading of the 404(b)(1) guidelines would compel the adoption of the smaller footprint because it impacts fewer wetland resources at the Bayport site while still providing for either six or seven wharves, depending upon whether the Shoal Point DEIS alternative or the GBCPA alternative at the Bayport site is utilized.

same as 2-154 14-19

Perhaps more importantly, the Shoal Point DEIS shows Shoal Point only impacting 13 acres of wetlands and Spillman's Island only impacting 3 acres compared to the Bayport DEIS that shows Shoal Point impacting 142 acres of wetlands and Spillman's Island impacting 207 acres of wetlands. It is hard to imagine that the Galveston District of the Corps of Engineers has produced two DEIS within months of each other that are so disconnected and contradictory. How is it that the Shoal Point DEIS has managed to minimize impacts whereas the Bayport DEIS has managed to make the impacts at other sites extremely high? This contradictory analysis must be rejected as arbitrary and biased. There must be an honest and fair appraisal of the alternatives and their impacts. Same as 14-51

Given that a private applicant at the Shoal Point site has requested a permit to construct a site with the smaller footprint, the conclusion is warranted that the smaller footprint meets the practicable alternatives test. This smaller footprint is available and capable of being done, as evidenced by a private permit application. It works from a logistics, cost and technology standpoint, again given a private application that incorporates this alternative. The smaller footprint alternative is indeed a practicable alternative.

Therefore, the major question is whether or not the impacts on the aquatic ecosystem of the Bayport proposal are more or less damaging than either the impacts at other sites or the impacts of the smaller footprint. To some extent, the answer to this question rests upon whether the impact on the aquatic ecosystem is based upon a full analysis of wetland acreage or is limited to jurisdictional acreage. In turn, this question emphasizes the importance of a correct jurisdictional analysis by the Corps. As set out in the Revised Public Notice, the proposed development at Bayport will impact 18.3 jurisdictional acres which is more jurisdictional acreage than either Shoal Point at 13 acres or Spillman's Island at 3 acres. In turn, based upon the prohibitions on discharge, the proposed Bayport site must be rejected because alternative sites and/or alternative configurations exist that are less damaging to the aquatic ecosystem. Same as 2-155

b. Overall Project Purpose

The first issue that must be addressed in an analysis of practicable alternatives under the §404(b)(1) guidelines is what is the alternative that is being evaluated. As set out in the Bayport DEIS (incorporated herein for all purposes), the Bayport alternative is both a container facility and a cruise terminal. Although the permit applicant may have defined the alternative to include both types of facilities, there is no technical or legal basis for the inclusion of a cruise terminal with a container terminal. There is no documentation that indicates some preferential basis for these uses being considered together. There is no synergy documented in any of the project descriptions. Indeed, the opposite conclusion appears warranted. 2-178

The attached alternative analysis by Dr. Ledvina clearly identifies an alternative configuration for the use of the Spillman's Island site from that shown in the Bayport DEIS. The cruise terminal could be located on the land that the Port of Houston owns on Pelican Island or through arrangements with the Port of Galveston. A cruise terminal in Galveston makes sense.

Galveston is a known tourist destination with established cruise terminals. It is the better place to locate cruise terminals.

The Bayport application is about a container port regardless of what is included on the diagrams. All of the back-up documentation concerns a container terminal. The Port of Houston is driven by the container business. The construction of a container port, not a cruise terminal, is the primary project purpose of this application. There is even discussion in the documentation that the cruise terminal might not be constructed. It is clearly a secondary concept if not a total fabrication. 2-179

Once the cruise terminal is separated from the container terminal, then the alternative analysis becomes realistic. Two sites are less damaging alternatives than Bayport. These are Shoal Point and Spillman's Island.

c. Spillman's Island

GBCPA submits that the Spillman Island site is a practicable alternative to the Bayport site. As set out in the Shoal Point DEIS and in Dr. Ledvina's analysis of alternatives, Spillman's Island can be developed with much less dredging and much less land area being required than set out by the Port of Houston. As such, a smaller site requires less site development costs associated with dewatering the spoil that currently exists on much of the site. By altering the configuration of the site relative to the Houston Ship Channel, the fast land on the northern edge of the site can be used, thereby also reducing the costs of site development.

The Port of Houston has maintained that the cost of site development for Spillman's Island is from $300,000 to $600,000 per acre. GBCPA disputes these figures. The Port of Houston stated that the cost of site preparation for the Shoal Point site was $600,000 at meetings of the Citizen's Advisory Group (CAG) that was sponsored by the Port of Houston. That statement was and is false. Attached is a study completed for the Texas City Megaport Project. That study shows that the cost of site preparation at Shoal Point, a dredged spoil site, is approximately $90,000 per acre, a figure clearly considered to be reasonable because there is now a permit application pending for the development of the Shoal Point site as a container port. GBCPA requests that the Corps retain S&ME to conduct an independent analysis of the cost of site preparation at the Spillman's Island site. 6-138

Spillman's Island is available and capable of being done, particularly given the elimination of the cruise terminal, a smaller footprint and a different orientation of the docks. Spillman's Island may cost more to develop but cost alone is not a determining factor in the analysis of alternatives under 404(b)(1) guidelines. However, the overall cost may be less with the smaller footprint and different orientation and reduced dredging that will come from the alternative alignment relative to the Houston Ship Channel. There are no logistical or technical issues. And the project purpose of moving containers into and out of the Houston-Galveston region will be attained. Spillman's Island is a practicable alternative to the Bayport site. It is less damaging to the aquatic environment than is the development of the Bayport site. 2-180

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d. Shoal Point

Shoal Point is clearly a practicable alternative to the Bayport site. The Shoal Point DEIS and Dr. Ledvina's analysis clearly show that Shoal Point is available and capable of being done, taking into account cost, logistics and technology in light of overall project purposes. 2-181

e. Conclusion

GBCPA submits that both the Spillman's Island site and the Shoal Point site are practicable alternatives. Both are available and capable of being done, taking into account cost, logistics and technology in light of overall project purposes. There are no unique wetlands on either of these two sites. Indeed, both have less wetlands and less important wetlands than does the Bayport site. Bayport should be rejected under the requirements of 40 CFR 230.10(a). 2-182

2. 40 CFR 230.10(c)

40 CFR 230.10(c) prohibits the discharge of dredge or fill material that will cause or contribute to significant degradation of the waters of the United States. Appendix 1 of the report by Dr. Jacob states the following:

> The Bayport wetland complex is one of the last large prairie pothole complexes of significant extent on the Upper Gulf Coast of Texas. The extent of this complex is important because there are few complexes left that are large enough to be a functioning ecosystem.
>
> * * *
>
> The Bayport DEIS makes no distinction about the quality of the wetlands between the different sites. The report treats them all equally, distinguished only by quantity. To consider the wetlands on the Bayport site in the same category as those at the Pelican Island and Shoal Point sites evidences a considerable lack of knowledge of local wetland resources. (Jacob Report, Appendix 1).

The wetlands on the Bayport site are unique and are important to the aquatic ecosystem of Galveston Bay. By contrast, the wetlands at Pelican Island, Shoal Point and Spillman's Island are within dredge disposal areas. To consider these wetlands to be the same as the wetlands at the Bayport site is a gross injustice and scientific error. same as 14-51

The purpose of §230.10(c) was to identify the significance of certain wetlands in comparison to others. It was to make the comparison of alternative sites meaningful and it was intended to protect important aquatic resources. The wetlands at Bayport are important. They should be protected.

3. 40 CFR 230.10(d)

Under 40 CFR 230.10(d), a permit to discharge into wetland areas should be denied unless all practicable mitigation steps have been undertaken. This analysis should be undertaken in conjunction with the Memorandum of Understanding (MOU) between the Corps and the EPA whereby it was agreed that wetlands are to be avoided if possible and that the extent of the fill should be minimized. Only after avoidance and minimization have been completed can the applicant turn to mitigation to offset the impacts of the action on the site. 14-91

From a mitigation standpoint, the first important point is that substantial acreage of wetlands can be avoided if the alternative site footprint from the Shoal Point DEIS is utilized rather than the Bayport DEIS footprint. This alternative footprint should be required in order to avoid the wetland areas in the central and southern portions of the site south of Port Road. Same as 2-154

Second, the acreage of wetlands that will be impacted from the filling activity must be accurately assessed. If the alternative footprint is utilized, then approximately 22 acres of wetlands will be filled according to the analysis prepared by Dr. Jacob. This is the number of acres that must be mitigated. It is against both the rules and policy of the Corps and EPA to allow mitigation to be utilized to offset wetland filling when a less damaging alternative site is available. Same as 2-55 14-60

III. Request Public Hearing and Supplemental DEIS

In light of the above comments, GBCPA requests the Corps (1) prepare a Supplemental DEIS to incorporate the revisions identified in the Public Notice and evaluate their impacts; (2) conduct an additional public hearing to eliminate the confusion about this proposal and to allow the public the opportunity to ask questions and express comments about the revisions identified in the Public Notice, and any Supplemental DEIS; and (3) extend the time for the public to comment on the revisions identified in the Public Notice and on the DEIS (and/or the Supplemental DEIS) after the public is provided with more complete information about these revisions as discussed above. 23-199

GBCPA also requests the TNRCC to conduct a public hearing based on this revised Bayport project proposal and the newly identified wetlands.

Sincerely,

BLACKBURN CARTER, P.C.

by _____
James B. Blackburn, Jr.

Attachments

ATTACHMENTS

A. Expert Opinions Regarding Wetlands Determination at Bayport Site (prepared for GBCPA) by John Jacob and Lawrence G. Dunbar, P.E.

B. Analysis of Project Alternatives in the DEIS for the Proposed Container Terminal at Bayport by Polly Ledvina

C. Site Preparation for Construction of Proposed Shoal Point Container Terminal by Shiner Moseley and Associates, Inc.

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Analysis of Project Alternatives in the Draft Environmental Impact Statement for the Proposed Container Terminal at Bayport

Polly Ledvina

for

Galveston Bay Conservation and Preservation Association

March 10, 2002

INTRODUCTION

The National Environmental Policy Act (NEPA) and the Clean Water Act require that a range of reasonable, feasible, and practicable alternatives, including the "No Action Alternative", be included in the environmental analysis. The purpose of including the alternatives analysis in the Environmental Impact Statement (EIS) is to document the decision making process whereby a single solution is chosen from a range of possible options. This analysis is intended to allow the impact produced by a proposed solution to be compared to those that would be produced by alternative actions, or by no action at all.

The validity of this method of justifying a proposed solution depends on an accurate analysis of the alternatives. Obviously, alternative solutions, which are inaccurate or incomplete, or in any other way bias the analysis in favor of a particular solution, defeat the purpose of the process. It will be shown that many such deficiencies and biases exist in the Project Alternatives section of the DEIS[1] for the proposed container terminal at Bayport.

A three-tier elimination process for determining "reasonable and feasible" alternative locations was described in the DEIS. Potential sites identified by the Tier 1 criteria included a) a minimum of 200 acres of upland property; b) accessibility to an existing deep-draft channel by an existing or new channel; c) the potential to develop a minimum of 2,000 feet of berth and wharf; and d) a location within the Galveston Bay/Freeport vicinity. The 78 sites determined by the Tier 1 criteria were reduced to 11 sites by Tier 2 criteria which considered: a) navigational access, b) dredging requirements; c) available backland; d) land development constraints associated with existing land use; e) road access; f) rail access; g) potential social impacts; h) and potential environmental impacts. In the Tier 3 elimination process the remaining 11 sites were evaluated singly or in combination against a more "focused and refined" application of the Tier 2 criteria to identify 7 locations, or combination of locations, as reasonable alternative terminal facility locations: Bayport, Cedar Point, Spilmans Island, Shoal Point, Pelican Island, a combination of Shoal Point and Bayport, and a combination of upper San Jacinto Bay and Bayport. Finally, for comparison purposes, a conceptual development plan was presented for each of the seven "action" alternatives as well as the "no action" alternative.

ANALYSIS AND DISCUSSION

Assumptions used in the conceptual development plan for each of the seven alternatives, directly determine how viable each site is relative to Bayport. It is apparent that in the DEIS for the container terminal at Bayport, limiting assumptions and errors in logic have biased the site selection process in favor of Bayport. Errors in the process can be summarized as follows:

1. Container and cruise terminal operations were not evaluated at separate alternative locations.
2. Container terminal layouts at the alternative locations were not optimized with respect to special requirements of each site.
3. Conceptual development plans at the alternative locations did not reflect special opportunities and resources of each site.
4. Alternative technologies to increase productivity per acre and/or reduce the terminal footprint were not explored.
5. Assumptions used in defining the "No Action Alternative" are not valid.
6. Significant discrepancies exist between the DEISs for Bayport and Texas City.

1. Container and cruise terminal operations were not evaluated at separate alternative locations.

The first illogical and unnecessarily limiting assumption was that the cruise terminal must be at the same location as the container terminal. Container terminal and cruise terminal operations have very different social, environmental, logistical and economic impacts and requirements. It

does not make sense for a site that may be excellent for a container terminal to be eliminated from consideration because of additional environmental burdens or land requirements imposed by a cruise terminal. Alternatively, a site ideally suited to the needs of the cruise industry, should not be rejected for this use because of impacts and requirements imposed by the container industry.

When combinations of sites were evaluated, the option of splitting the cruise terminal and the container terminal should have been considered. Segregated, the two operations could have been located at sites most ideally suited for their own individual specific needs and impacts. Instead, a very illogical solution was presented in the DEIS whereby the container operation was split to occupy two separate sites and the cruise terminal was tagged onto a fraction of a container terminal.

This serious flaw in the analysis predisposed the outcome of the selection process in two important ways. First, on a logistical basis alone, it guaranteed the elimination of all the presented Combination Site alternatives. As discussed in the report, a container terminal split between two sites is likely to require a duplication of support services and infrastructure that would not be necessary if the entire terminal was located at a single site. Similarly, more efficient land transportation is possible when dealing with a single container import/export destination. For example, direct rail between the terminal and inland destinations becomes much more feasible when critical numbers of containers can be loaded at a single site. Also, trucks are more likely to have both a pick-up and drop-off on a single trip when the operation is large and at a single site. They are less likely to spend time on the road, without containers, moving back and forth between drop-off and pick-up points at different terminal sites.

The differences in operational efficiencies between a container facility located at a single site and one split between multiple sites translate into significant environmental, as well as the aforementioned economic/logistical impacts - all good reasons for the Combination Alternatives to be eliminated in the selection process. Clearly, the Combination Alternatives, as presented in the DEIS with split container terminals, could not have been seriously intended as viable alternatives. Combination Solutions intended as viable alternatives would have been those that placed the container terminal at one location and the cruise terminal at another. Rather, the Combination Alternatives presented in the DEIS might more accurately be characterized as "straw" alternatives – flimsy alternative schemes which may easily be eliminated.

There is another very important way that not segregating the cruise and container terminals predisposed the outcome of the site selection and justification process. The much larger footprint and additional water frontage required by a joint operation, as opposed to either operation alone, places strong selective pressure against alternative sites that are active Dredge Material Placement Areas (DMPA) (Shoal Point, Spilmans Island, Pelican Island). This is true for the following reasons:

1. It costs more to build on a DMPA than on an otherwise equivalent site because soil consolidation is required. This cost differential increases with the size of the terminal footprint. Linking the operations at a single site exacerbates the differential between development costs at Bayport relative to Spilmans Island, Shoal Point, or Pelican Island.

2. Dredging is a particularly critical consideration in using active DMPA sites. Loss of capacity at an active site occurs two ways: when new dredge material is placed at the site, and/or when the site becomes unavailable because of a change in designated land use (eg a DMPA becomes a cruise terminal or a container terminal). In terms of lost capacity, the additional terminal inflates the differential between DMPAs and a non-DMPAs by both possible mechanisms: a) it increases the need for dredging and, b) it decreases the land available for material placement.

Obviously, if an active DMPA were to be seriously considered as an alternative site to Bayport, the conceptual plans for this site should reflect the special conditions of its development. A viable container terminal layout at this sites would necessarily be one that required the minimal amount of land to accommodate the terminal foot print and the minimum amount of dredging to allow access. The cruise terminal should be separated from the plan for container terminal. It is not appropriate to incur a loss of capacity at a DMPA site for a cruise terminal when that cruise terminal has no particularly important logistical reason for being there, and could easily be located elsewhere.

2. Container terminal layouts for the alternative locations were not optimized with respect to special requirements of the sites.

As described in the preceding section, the size of the footprint and the amount of dredging required, are particularly critical issues when considering a DMPA as an alternative location. The conceptual development plans presented for these locations do not reflect these special conditions. Comparison with the acreage requirements of container terminals presented in the Texas City DEIS suggests that those presented in the Bayport DEIS are on the high side (Figures 1 & 2). As presented in the Texas City DEIS, a 6-berth container terminal requires only 400 acres of waterfront land. In contrast, the 7-berth facility in the Bayport DEIS demands twice that amount. It is no coincidence that the proposed site in the Texas City DEIS is a DMPA and that in the Bayport DEIS is not. A bloated footprint biases against DMPA locations.

The container terminal at Spilmans Island, even without the cruise terminal, has been laid out in a configuration that actually maximizes upland excavation. As presented in the DEIS, the existing channel must be extended by 7000 feet into the island to accommodate the 7 new berths of the container terminal. A "reasonable and feasible" layout, intended to minimize dredging and upland excavation, would have placed those berths around the perimeter of the site rather than through the middle of it. (Figure 2) This more viable configuration was, in fact, the one presented for Spilmans Island as an alternative in the DEIS for Texas City's Proposed Shoal Point Container Terminal.[2]

As laid out in the DEIS for Bayport, the newly excavated open water area would be approximately 7,000 feet long and 2,200 feet wide and would produce 27 million cubic yards (mcy) of material.[3] In contrast, the Spilmans Island alternative in the Texas City DEIS, which located 6 berths on the perimeter of Spilmans Island, was estimated to produce only 9.6 mcy of material (7.7 mcy for the channel and berthing area and 1.9 mcy for a new turning basin).[4]

Justification for the configuration presented in the Bayport DEIS for Spilmans Island is difficult to imagine. In terms of operational logistics, there are no clear benefits to be obtained from orienting the terminal backlands away from the existing facility at Barbours Cut. For container handling and transport, it would be more efficient to orient the terminal with the backland closest to Barbours Cut as was presented for Spilmans Island in the Texas City DEIS.

In the DEIS for Bayport, no specific effort was made to reduce the size of the container terminal footprint at DMPAs relative to those sites that are not placement areas. One possible way of doing this would have been to move the intermodal rail yard off-site where land is less expensive to develop, as was proposed for Shoal Point in the Texas City DEIS. Significantly, none of the conceptual development plans presented for alternative locations in the DEIS for Texas City include on-site intermodal yards. In the Bayport DEIS, however, all of the layouts include on-site intermodal yards. Relocating the intermodal yard from DMPAs would reduce the area requiring consolidation by 123 acres.

The same reasoning applies to terminal space designated for warehousing containers. It is not prudent to squander waterfront acreage, especially DMPA acreage, for long-term storage of containers. This function may be accommodated on less costly land just off site. While this point

was made in the DEIS regarding empty containers, it is also true for full containers. The error of including on-site long-term storage (>3-4 days) at alternative sites that are DMPAs exaggerates the cost differential between building on these sites versus Bayport.

The above factors taken into consideration, the acreage requirements for DMPA locations in the DEIS for Bayport will be more in line with those shown for the same sites in the DEIS for Texas City.

3. Conceptual development plans at the alternative locations did not reflect special opportunities and resources of each site.

Just as the layouts for the alternative locations did not provide for specific weaknesses of a site, neither did they capitalize on any particular advantages or resources an alternative location might offer. When the same generic footprint is applied to each location without regard to specific deficiencies or opportunities of that site, the validity of the alternative analysis becomes questionable.

The most obvious examples of missed opportunities are seen in the plan for Spilmans Island. Logistically, Spilmans Island is superior to all other sites. It is virtually the same distance as Bayport from the mouth of the ship channel, but has the unique advantage of being contiguous with the existing container facility at Barbours Cut. Proximity to Barbours Cut would allow the new container facilities to share existing resources. Nowhere in the DEIS is the potential for this mutually beneficial relationship reflected in the layout for Spilmans Island presented. This is a major error in the analysis of the alternative. If the new container terminal were to be sited at Spilmans Island there would be no need for the total redundancy of infrastructure as is currently indicated in the DEIS.

The same reasoning that disqualified the split facilities of the combination alternatives argues strongly in favor a Spilmans Island/Barbours Cut joint facility. An alternative that involves operations at one joined location increases operational efficiencies relative to one involving operations at two separate locations such as Bayport and Barbours Cut. For example, having the facility at one location, eliminates the need for truck drivers to transit between two separate sites to load an incoming container after unloading a container.

It is a developmental and operational error to show an intermodal yard on the plan for Spilmans Island. It is a prime example of a failure to incorporate unique advantages of each locations into the plans presented in the DEIS. It would make sense that a new Spilmans Island/Barbours Cut joint facility would use the intermodal yard already present on Barbours Cut rather than build one on DMPA land. In fact, this is the strategy presented in the Texas City DEIS for the Spilmans Island alternative. The cost for transporting containers to this existing railyard (necessary for all locations in the early years of development) will be less for Spilmans Island than Bayport, or any other alternative.

As is, the existing Barbours Cut intermodal yard may not be able to handle the total marshalling traffic required when the Spilmans Island terminal is fully expanded; however, it is preferable to assess the existing capabilities of this intermodal yard with the higher throughputs, and expand this facility, as opposed to jumping into the construction of a new intermodal facility on Spilmans Island itself. For the truck traffic, there is a similar issue with the gates and aprons. A new terminal at Spilmans Island may tie into the gates of the existing intermodal facility. Again, this may need to be expanded due to the higher throughputs, but it is better to start with an assessment of the existing facility (and an option to expand) than jump to new construction. Ultimately, Spilmans Island and Barbours Cut, sharing one yard at a single location, will be more economically viable (lower costs and higher efficiencies) than using two intermodal yards at two separate locations as is currently proposed in the Bayport plan.

Similarly, it is an error to dedicate any significant amount of land on Spilmans Island to the storage of containers. Currently, Barbours Cut uses relatively little on-site land to store or maintain empty containers. Proximity to private off-site container warehouse facilities is a key factor to the high throughput per terminal acre Barbours Cut is able to achieve. It is illogical and inaccurate to expect operations occurring differently on Spilmans Island. Economic and environmental pressure would dictate that existing and new off-site warehouse facilities would continue to be used and shared by a terminal extension that occurred on Spilmans Island. While the need to store empty containers off-site was mentioned in the DEIS, no mention was made concerning the long term storage of full containers. The existing operation at Barbour's Cut, as well as a new facility at Spilmans Island, would reduce container dwell time by using these (or new) off-site facilities for the long-term storage (>3-4days) of full containers. Waterfront land should not be squandered warehousing containers waiting transport. The error of including on-site long-term storage, inflates the amount of land required for a new terminal and exaggerates the cost differential between building on DMPA sites versus Bayport.

4. Alternative technologies to increase productivity per acre and/or reduce the terminal footprint were not explored.

Technologies to efficiently move containers were not explored. This omission is inconsistent with the applicant's stated need to remain competitive as a major international container port. It is also inconsistent with the stated intent of the DEIS to "identify and evaluate a range of reasonable alternatives to accomplish the purpose of the proposed project, and to evaluate potential effects that the action alternatives may have on the environment".[5]

The working assumption in the DEIS is that productivity increases incrementally according to the formula: 1000 feet of wharf plus 100 acres of backland yields a maximum throughput of about 200,000 TEU per year. This "planning criteria," intended to guide the next 20 years worth of port development and secure a competitive place in the future world container market, seems to ignore the fact that there are already terminals, Pasir Panjang Terminal in Singapore, for example, with average throughputs per berth of 750,000 TEUs per year.[6] Achieving twice the throughput means a reduction in the requirement for berths by 50%. It would also mean a faster turnaround time for ships and increased marketability for the port.

In the development of a Master Plan for Port Everglades, a listing of conceptual and currently in-use automated terminal container handling systems was prepared by TranSystems Corporation.[7] This document presents clear evidence that the container industry is moving towards automation. The DEIS for Bayport completely failed to identify and evaluate any technologically progressive solutions which might better protect the economic, environmental, and social interests of tax-payers. A comparable technological review, as relevant to Bayport and the alternative sites, should have been included in the Bayport DEIS.

For comparative purposes, the layout of a conceptual system developed by ACTA Maritime Development Corporation, SPEEDPORT, is shown for Shoal Point and Spilmans Island (Figures 1 & 2). SPEEDPORT is a very compact self-contained terminal which provides extremely high productivity per acre.[8] In SPEEDPORT terminals, ships berth perpendicular to the coast, reducing the amount of waterline required, and because the entire facility is covered, light and noise impact is greatly reduced. Briefly, the terminal uses multiple automated "spider" vehicles operating on an elevated grid of rails and overhead beams to increase the number of lifts and provide direct transport to trucks, trains, or interim storage. The availability of numerous spiders, and their self-contained hoists and spreaders allows all cells of the ship to be accessed at the same time. The speed of container transfer depends on the size of the ship and the number of spiders moving containers to and from the transfer and storage area, but a 4500 TEU ship can be loaded or unloaded at a rate of about 400 TEU per hour.

SPEEDPORT is mentioned as just one example of how computer technology and automation is moving the container industry into the future. Relative to Asian ports, the United States has been reluctant to develop automated container terminals. This will not last, however, as economic and environmental forces will dictate otherwise. The founders of ACTA Maritime Development Corporation forecast the following:

> The numbers of containers carried on the mega-ships of the future will overwhelm a terminal designed in conformance with today's paradigm of single or two sided berths employing conventional gantry cranes. As ports plan to accommodate the envisioned 10,000+ TEU ships of the future, they cannot continue to rely on minor modifications and extensions of their existing physical plants. (Typical port improvement plans usually include increasing terminal acreage and employing more standard gantry type cranes and ancillary container handling equipment.) Even with these improvements, an inordinate amount of time will be required to work cargo and service large ships in these facilities. The drive to minimize downtime in port will cause carriers to demand alternative terminal designs. Likewise, ports themselves will be in competition for the traffic of the major shipping alliances. The port offering the fastest, safest service at the lowest cost overall will attract the container traffic.[9]

Additionally, there is a need to automate as waterfront land becomes scarce.

In assessing the viability of alternative locations, the DEIS for Bayport failed to consider future trends in shipping and container handling. The trend in the container industry to a smaller terminal footprint and increased efficiency translates to a diminished cost differential between a DMPA site, like Shoal Point, and a non-DMPA site, like Bayport. Differences between Shoal Point and Bayport are further diminished when trends towards much larger carriers are considered. Because of its better proximity to the gulf, Shoal Point will more easily become accessible to very large ships than Bayport. (The accommodation of these larger ships will require a deepening of channel access beyond the 45' currently proposed in both the DEIS for Bayport and the DEIS for Texas City. This future deepening will be most environmentally and economically feasible for the Texas City location.) The ramifications of a site, adopting the methodologies and techniques for loading and unloading the ships of the future – the formidable competition it would represent to other more conventional ports in the area – were not considered.

The DEIS is flawed because it is does not recognize and account for technological change that could greatly reduce impacts on neighborhoods, coastal ecologies, and affect the competitive advantage of the port.

5. Assumptions used in defining the "No Action Alternative" are not valid.

The purpose of including the "No Action Alternative" in the analysis is to allow the environmental and social impacts that would be incurred by a proposed project to be compared with those that would be incurred without the project.

In the DEIS for Bayport it has been assumed that under the No Action Alternative,

> The Applicant-owned portion of the Bayport site would be developed for other types of port facilities similar to those now located along the western portion of the Bayport Channel consistently with the current land use designation. Likely facilities include liquid bulk cargo terminals,

petrochemical facilities, and similar industrial facilities requiring direct waterfront locations.[10]

Equating "no action" with "equally bad action" defeats the purpose of the EIS and makes a mockery of the process. No explanations or forecasting data to support a given future for the Bayport site are provided. Instead, unsupported assumptions are used to create a bleak future for the site, whether the container port is constructed or not. How can the EIS be an instrument for protecting the natural environment and neighboring communities when loss of both is presumed from the beginning?

The No Action Alternative as defined in this Bayport DEIS fails to anticipate a realistic future for this site. At least four major problems are evident: First, the Port of Houston Authority had initially proposed the use of 500+ acres of the Bayport site for the disposal of dredged spoil. This is a reasonable foreseeable use of the land that would be compatible with existing needs, functions, and expectations. Given that the land was purchased for this cause, dredge disposal is reasonable use for at least one-half of the site under a No Action Alternative.

Second, heavy industrial use of a portion of this land is prohibited by the zoning ordinance of the City of Seabrook as set out in the analysis by GBCPA consultant Lydia Jemison. At the least, the land in Seabrook is not available for heavy industrial use.

Third, the Port of Houston does not own some of the land proposed for the Bayport container port. There is no evidence that the goals of landowners other than the Port of Houston Authority have been considered in the No Action Alternative.

Fourth, the heavy industrial development assumed in the Bayport DEIS requires extensive air quality permitting. The Houston area is non-attainment for the 1-hour ozone standard and data included in the Bayport DEIS and in these comments by GBCPA indicate major attainment issues regarding the PM10 24-hour and annual standard and the PM2.5 annual standard. No explanation of these permitting issues is provided to support the no action alternative.

In short, the No Action Alternative presented in the DEIS is not valid. It attempts to rationalize the use of the Bayport site as a container port by making the alternative future appear much worse than the likely reality. No data, analyses, or explanations have been provided to support the assumption that industrial expansion at this site is inevitable.

6. Significant discrepancies exist between the DEISs for Bayport and Texas City.

The same alternative sites have been analyzed for container terminals at Texas City and Bayport, in two separate DEISs prepared by the Corps. For permits to be issued, each EISs must demonstrate that "no practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." Given this constraint, it is reasonable to expect that two DEISs conducted fairly and objectively would produce similar findings and conclusions. In fact, however, the two studies differ in many very significant ways.

While both of the proposed projects use only conventional technology for terminal operations, the planning criteria used to determine respective land requirements was dramatically different. In the Bayport DEIS, it was presumed that each berth would require 100 acres of associated backland. In contrast, as presented in the Texas City DEIS, 125 acres is a sufficient amount of backland for 2 berths. At final build-out, the 7 berths proposed in the Bayport DEIS, would require 700 acres of backland, while the 6 berths proposed in the Texas City DEIS would require only 400 acres. Ultimately, the two terminals are projected to have the same throughput of a little over 2 million TEU per year.[11]

While both of the proposed projects recognize the need for container transport by rail, only in the Bayport DEIS is there the mandate for approximately 100 acres to be dedicated to an on-site intermodal facility at each location. This is in sharp contrast to the Texas City DEIS, where a feasible off-site intermodal yard has been assumed for the proposed and all of the alternative locations.

As previously discussed, the difference in footprint size dictated by these two very different planning criteria is important because it has a direct bearing on the environmental impact of alternative sites, relative to the proposed site, as well as on the total impact of the project. A container terminals with an excessively large footprint produces unjustifiable total damage to the environment and potentially biases the alternative analysis against dredge spoil sites. In the Bayport DEIS three of the four alternative sites that are large enough to accommodate the proposed container terminal are dredge spoil sites.

The more reasonable footprint for the container terminal presented in the Texas City DEIS reflects the reality that the proposed location is a dredge spoil site. The minimal footprint proposed for Shoal Point is one that will provide the same desired economic function and have the least adverse impact on the aquatic ecosystem. It is the footprint that should be used in the Bayport DEIS to evaluate the viability of alternative locations.

Another difference in the two DEISs pertains to terminal layout. In the Texas City DEIS terminals were laid out to minimize dredging. In the analysis of Spilmans Island and Pelican Island, berths were placed on the perimeter of the landmass to minimize the need for dredging and upland excavation. Inexplicably, in the conceptual designs for these same sites in the Bayport DEIS the berths are accessed via new channels dug through the centers of the landmasses. When it is clear that a major goal in site selection is to minimize dredging, these configurations defy explanation. The only possible reason to lay these sites out so poorly would be to maximize adverse impacts, thereby biasing the selection process against these sites.

RECOMMENDATIONS

Many errors and deficiencies in the Alternative Analysis section of the Bayport DEIS have been discussed. For the DEIS to be valid, the following corrections must be made:

1. Alternative locations for the cruise terminal and the container terminal must be evaluated separately. Alternative possibilities must reflect the very different environmental, social, and economic needs and impacts of a cruise terminal versus a container terminal.

2. Container terminal layouts at the alternative locations must be optimized with respect to special requirements of each site. For DMPA sites this means that terminals must be laid out to minimize the size of the footprint and the amount of dredging required. In the case of DMPAs, intermodal yards and empty container storage areas must be moved off-site. To minimize dredging requirements and maximize operational efficiency, the layout for Spilmans Island should be reoriented with the berths towards the perimeter and the backlands toward the existing facility at Barbours Cut. These changes are "reasonable, feasible and practicable" as evidenced by their presence in plans for these same sites in the DEIS for Texas City.

3. Conceptual development plans for the alternative locations must reflect the resources and opportunities of each site. In particular, the plan and analysis for Spilmans Island must accurately reflect shared resources afforded by close proximity to Barbours Cut. Redundant infrastructure must be removed from the DMPA site. The economic and environmental advantages of a combined site (Barbours Cut/Spilmans Island) versus a split site (Barbours Cut and Bayport) must be included in the analysis.

4. Future trends in the shipping and container handling industries must be included in the Alternative Analysis. Whether a location or conceptual plan has the potential to adapt to future market demands and environmental constraints must be considered. Modern technologies to increase productivity per acre are necessarily a part of this analysis. These issues are particularly relevant to any DMPA sites where an over-sized footprint was considered the major determining factor of a locations economic and environmental viability.

5. The Corps must reconsider the no action alternative for the proposed Bayport site. A full explanation of the development assumptions included in the no action alternative, including explicit identification of the scale and type of industrialization foreseen is needed. The Corps must account for goals of landowners other than the Port of Houston and it must provide a credible analysis to support the assumption that industrial expansion at this site is inevitable.

6. Important differences in the analyses presented in the DEISs for Texas City and Bayport must be reconciled. For the same economic gain, the planning criteria and terminal layouts presented in the Texas City DEIS will minimize the damage to the environment, as well as the bias in the site selection process. It is recommended that these criteria be adopted for the analysis of alternative sites in the DEIS for Bayport.

NOTES

1. USACE, Draft Environmental Impact Statement for the Proposed Bayport Container Terminal, Pasadena, Harris County, Texas (Nov 2001), pp. 2-1 – 2-37. http://www.swg.usace.army.mil/reg/pha/DEIS/MainPage.pdf

2. USACE, Draft Environmental Impact Statement for the Proposed Shoal Point Container Terminal, Texas City, Galveston County, Texas (Jan 2002). See Figure 2.4.5-1, p. 2-37. http://www.swg.usace.army.mil/reg/txcity/txcity.htm

3. DEIS, Bayport, p. 2-20.

4. DEIS, Texas City, p. ES-8.

5. DEIS, Bayport, ES-1.

6. TranSystems Corporation, *Element 4. Strategy Development: Section 4. Trends in Gate and Terminal Design* (August 23, 2001) p. 4-30. http://www.co.broward.fl.us/poi05000.htm

7. *Ibid.*, pp. 4.18 – 4.31.

8. Arntzen, John and Thorsen, Richard, *Improved Terminal Efficiency – SPEEDPORT$_{TM}$, Terminal Design and Operating System for the 21st Century,* presented at Container Handling Automation and Technologies Conference, London, England (Feb 22-23, 1999) and Port Financing Conference, Miami, Florida (Feb 22-23, 1999). See also http://www.frontiernet.net/~rthorsen/

9. *Ibid.*

10. DEIS, Bayport, p. 2-20.

11. DEIS, Texas City, p. 2-5 and DEIS, Bayport, p. ES-14.

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Architecture History Recitation, Aug 1998 - May 2000 University of Houston, Houston.
Biochemistry Recitation, Sep 1984 - Jan. 1988, Dept. of Biochemistry, Rice University, Houston.
Student Research Supervision, Feb. 1988 - June 1992, and Feb. 1994 - Aug. 1996, Structural Biology Dept., Howard Hughes Medical Institute, Baylor College of Medicine, Houston.
Biology Laboratory, Sep 1980 - Dec. 1980, Dept. of Biology, University of Houston, Houston,.

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Urban Design Consultant to Gulf Coast Institute, Sep 2001 – present, Houston, TX.
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Member of Nature Center Planning Committee, River Oaks Elementary, Houston, TX, Nov 2001 – present.
Recipient of Honor Award for the design of an arena for the Progressive Amateur Boxing Association, May 2001, Houston, TX.
Member of Entrances and Perimeter Committee, May 2000 – Sep 2000, University of Houston.
Participant in UH design-build project: an outdoor classroom for UH charter school, Jan 1998 - Sep 1999, Houston, TX.

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Vermersch, P. S., Tesmer, J. J. G., Lemon, D. D., and Quiocho, F. A. A Pro to Gly Mutation in the Hinge of the Arabinose-binding Protein Enhances Binding and Alters Specificity: Sugar-binding and Crystallographic Studies. J. Biol. Chem. 265 (1990): 16592 – 16603.

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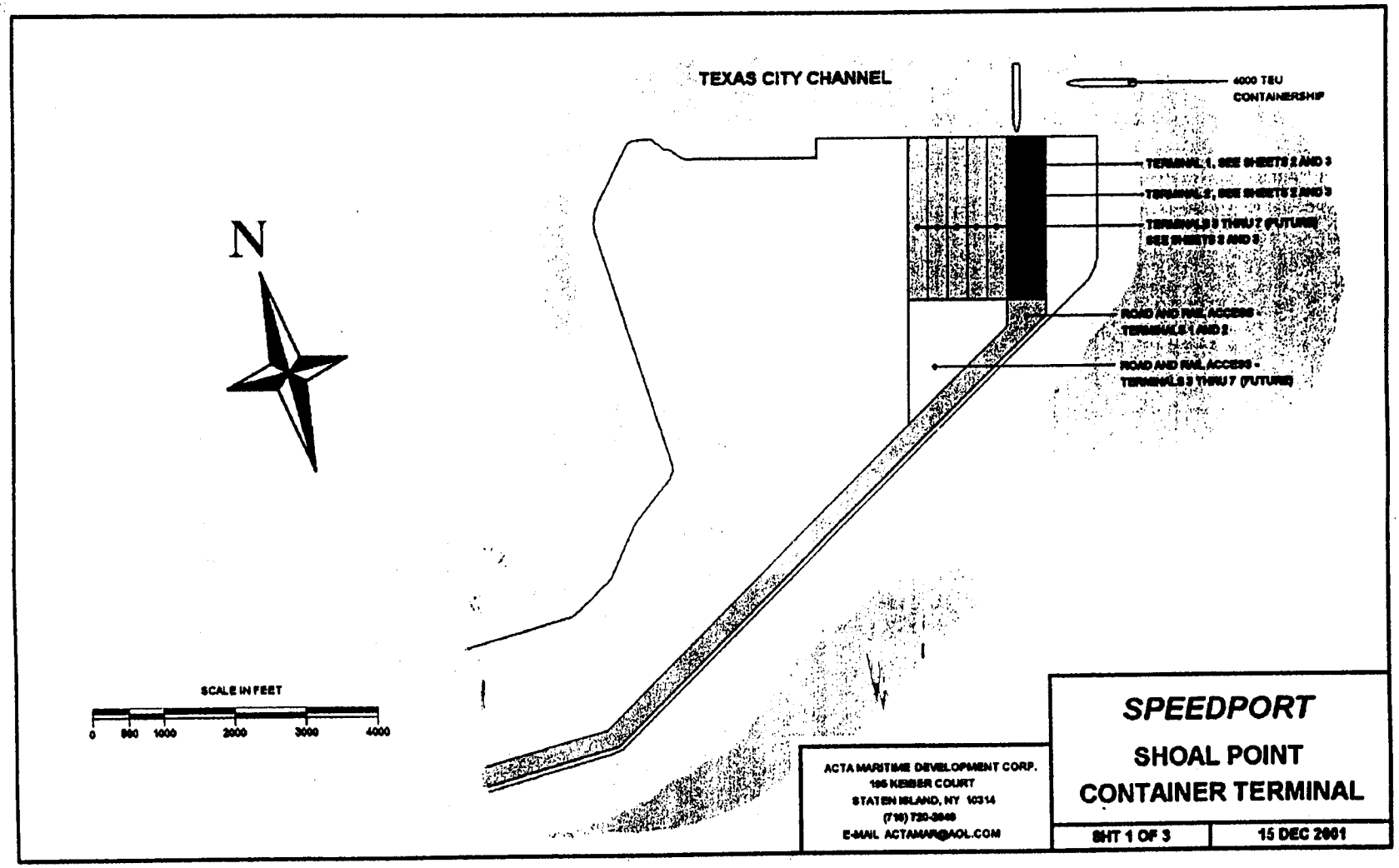
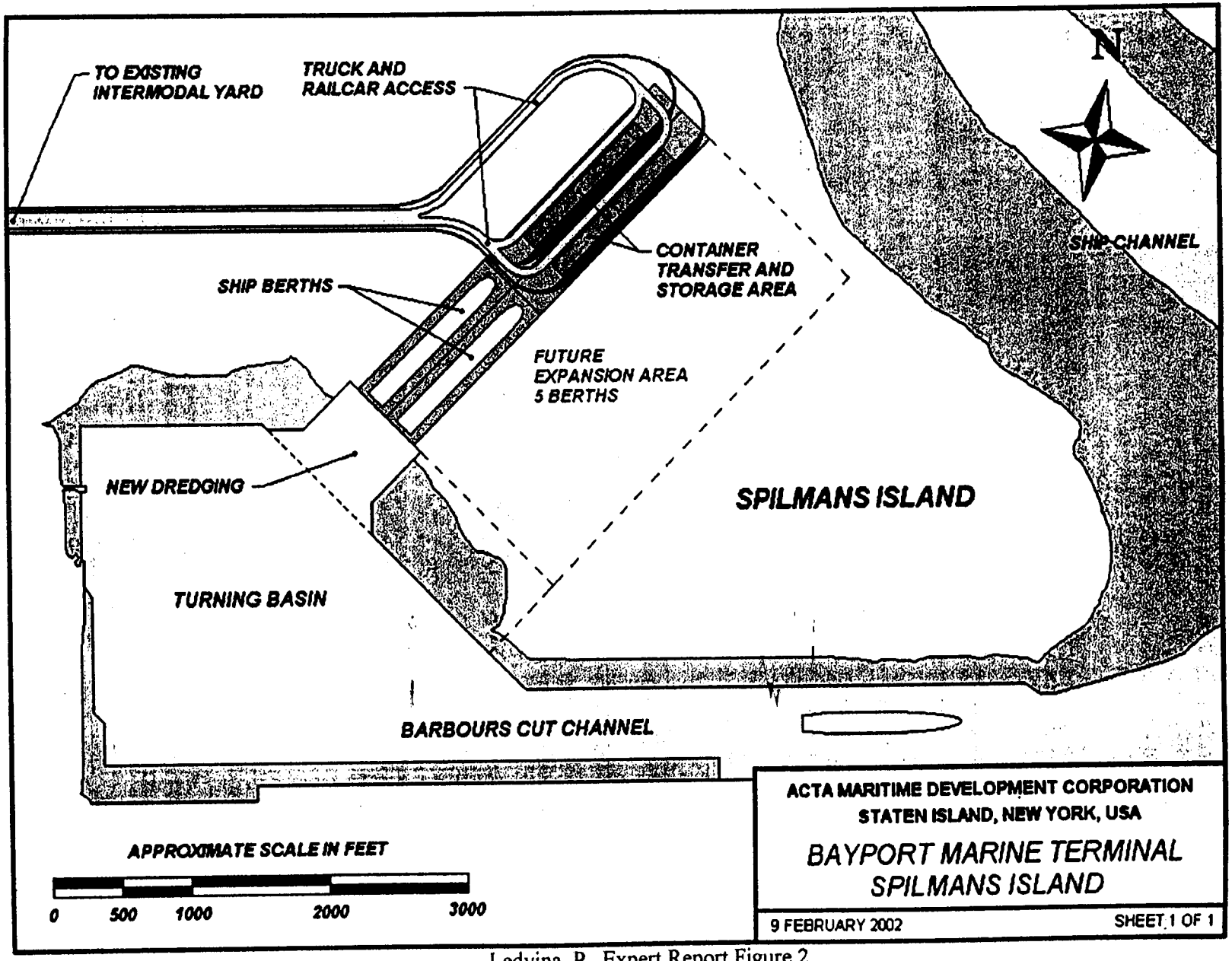


Ledvina, P. Expert Report Figure 1



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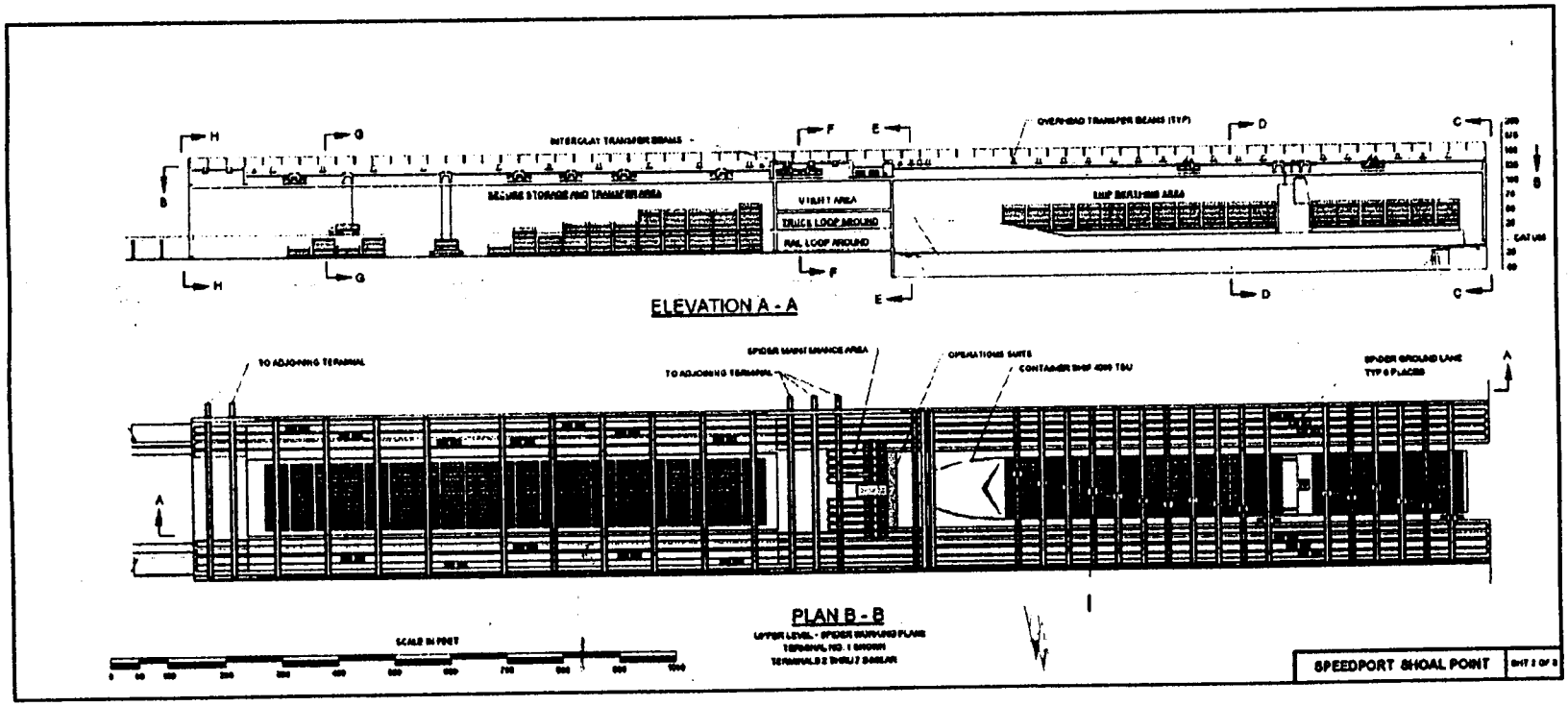

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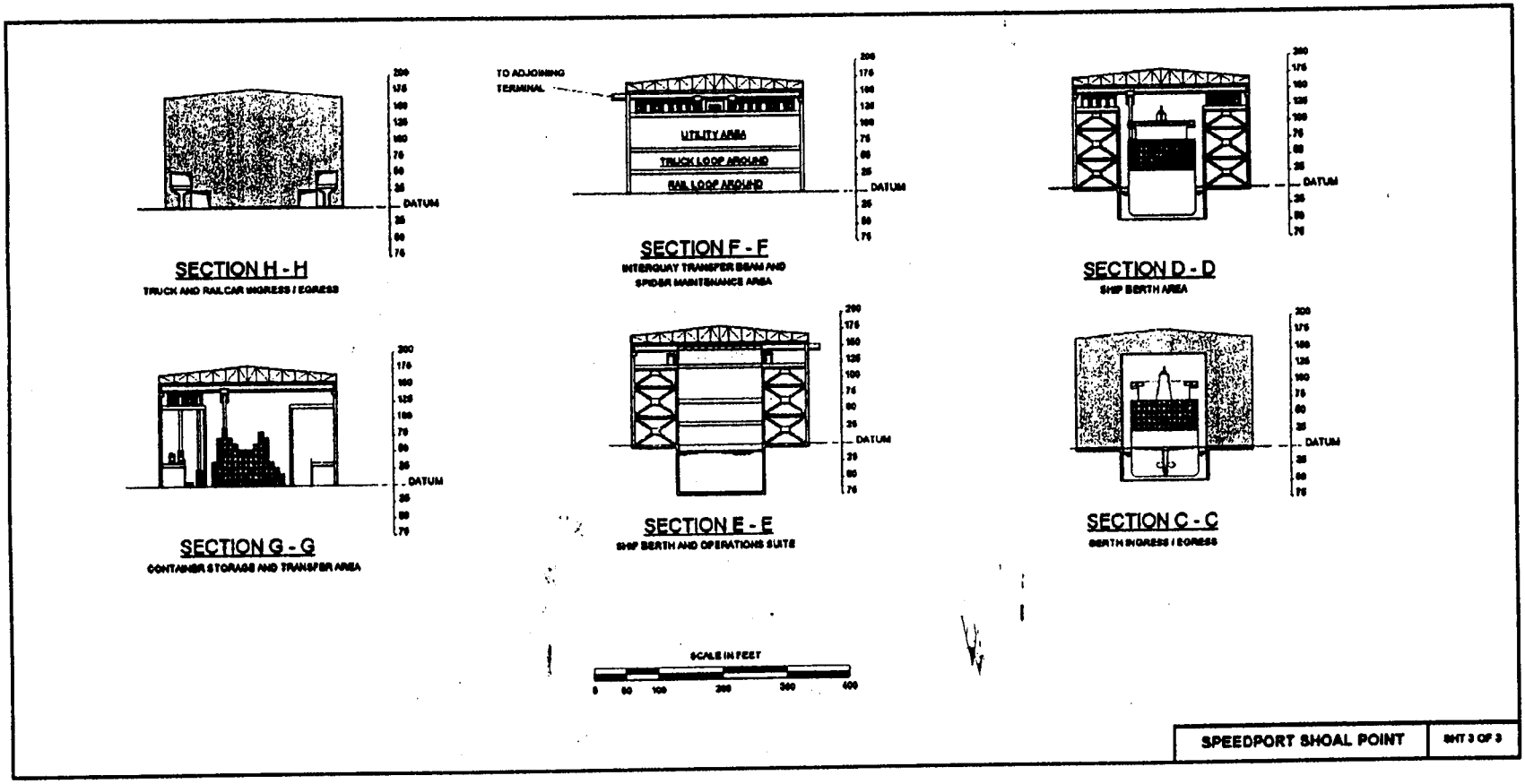
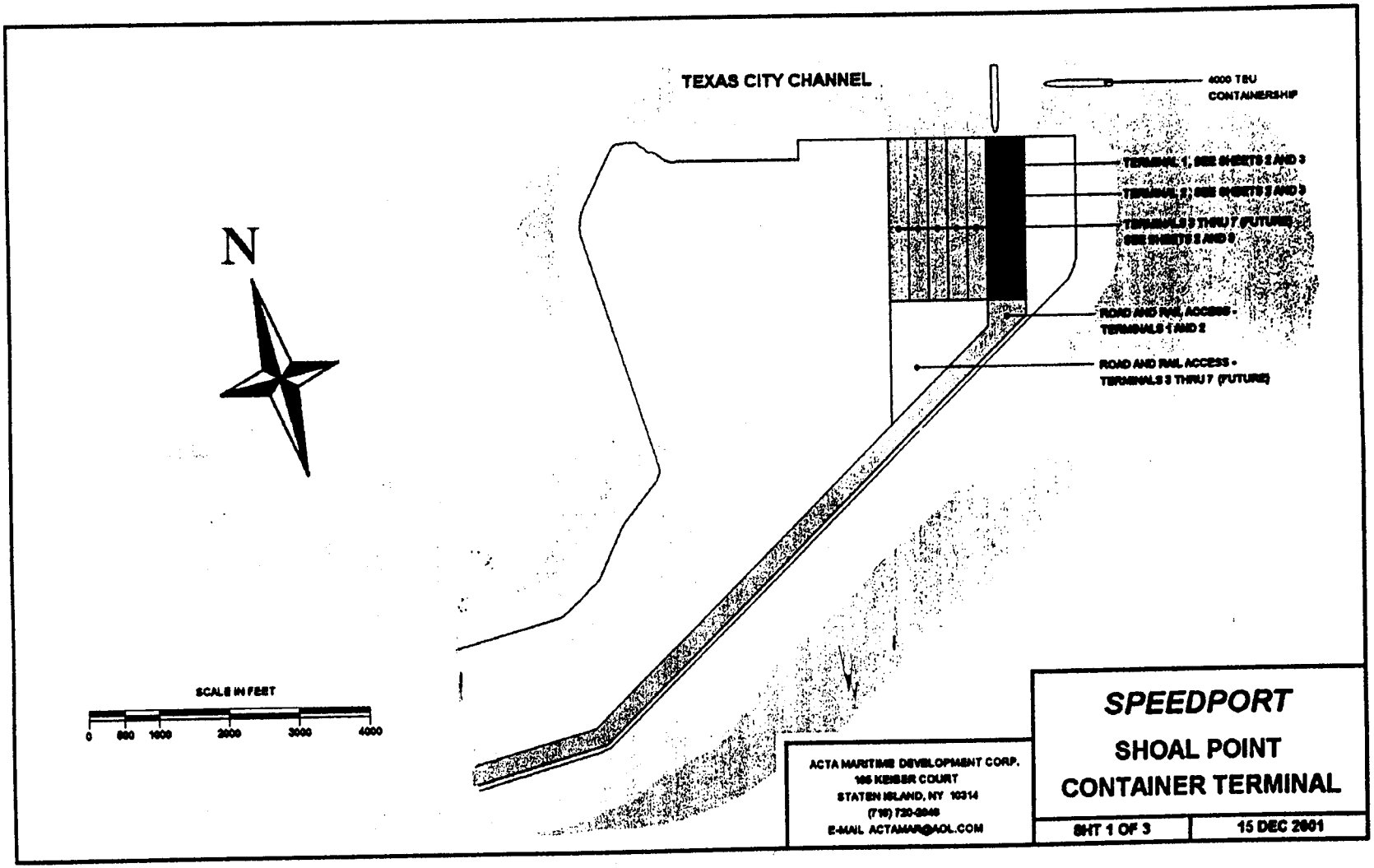


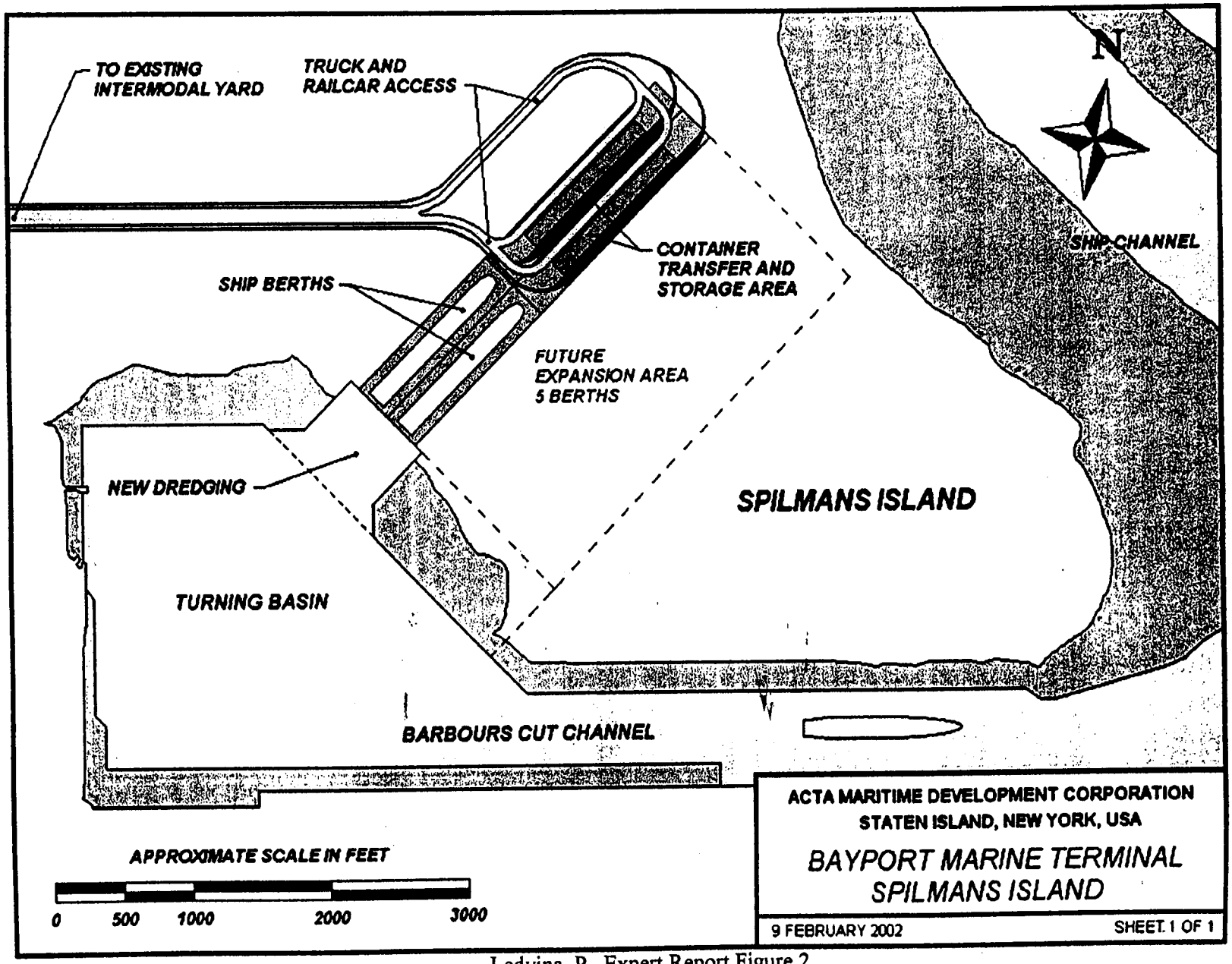
Ledvina, P. Expert Report Figure 4

Ledvina, P. Expert Report

Supporting Images
(16 plus cover sheet)



Ledvina, P. Expert Report Figure 1



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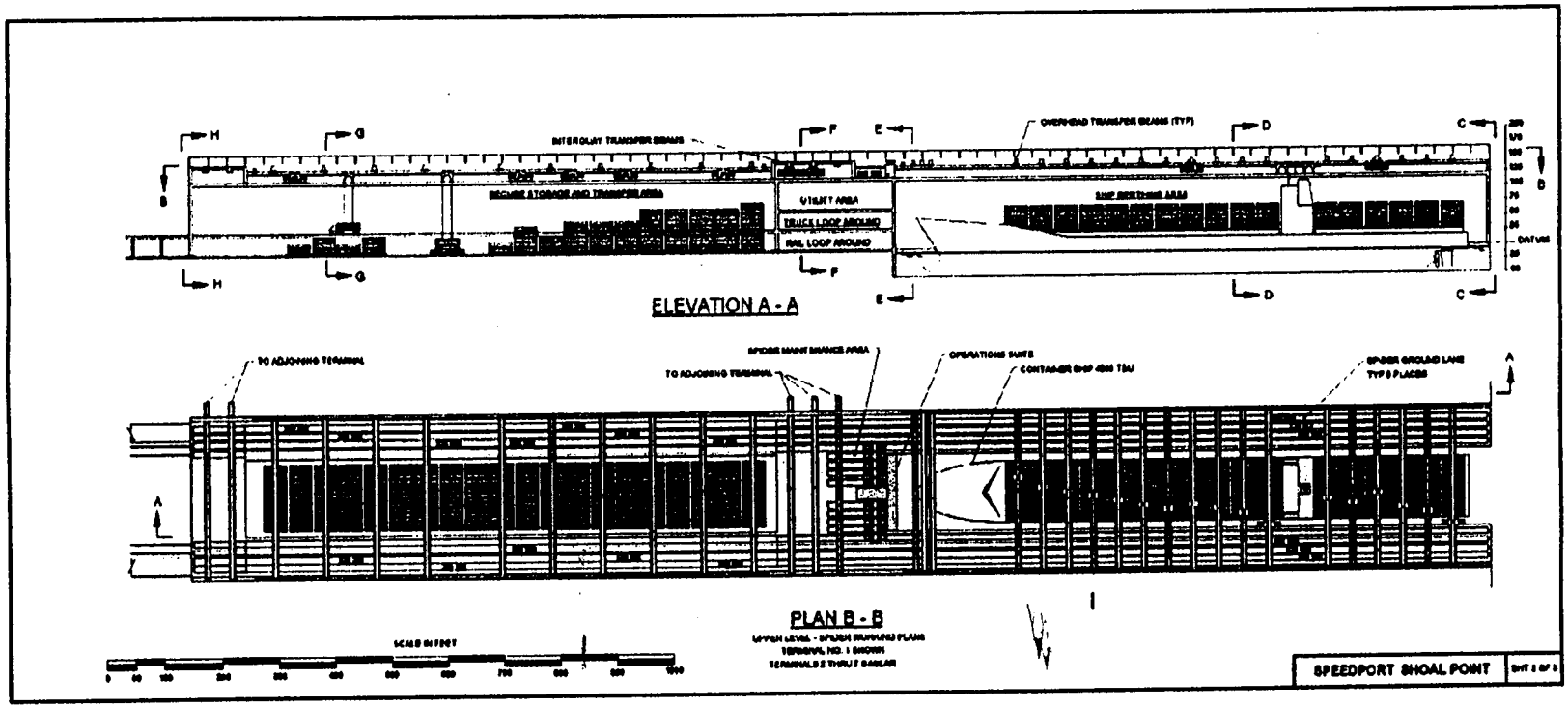
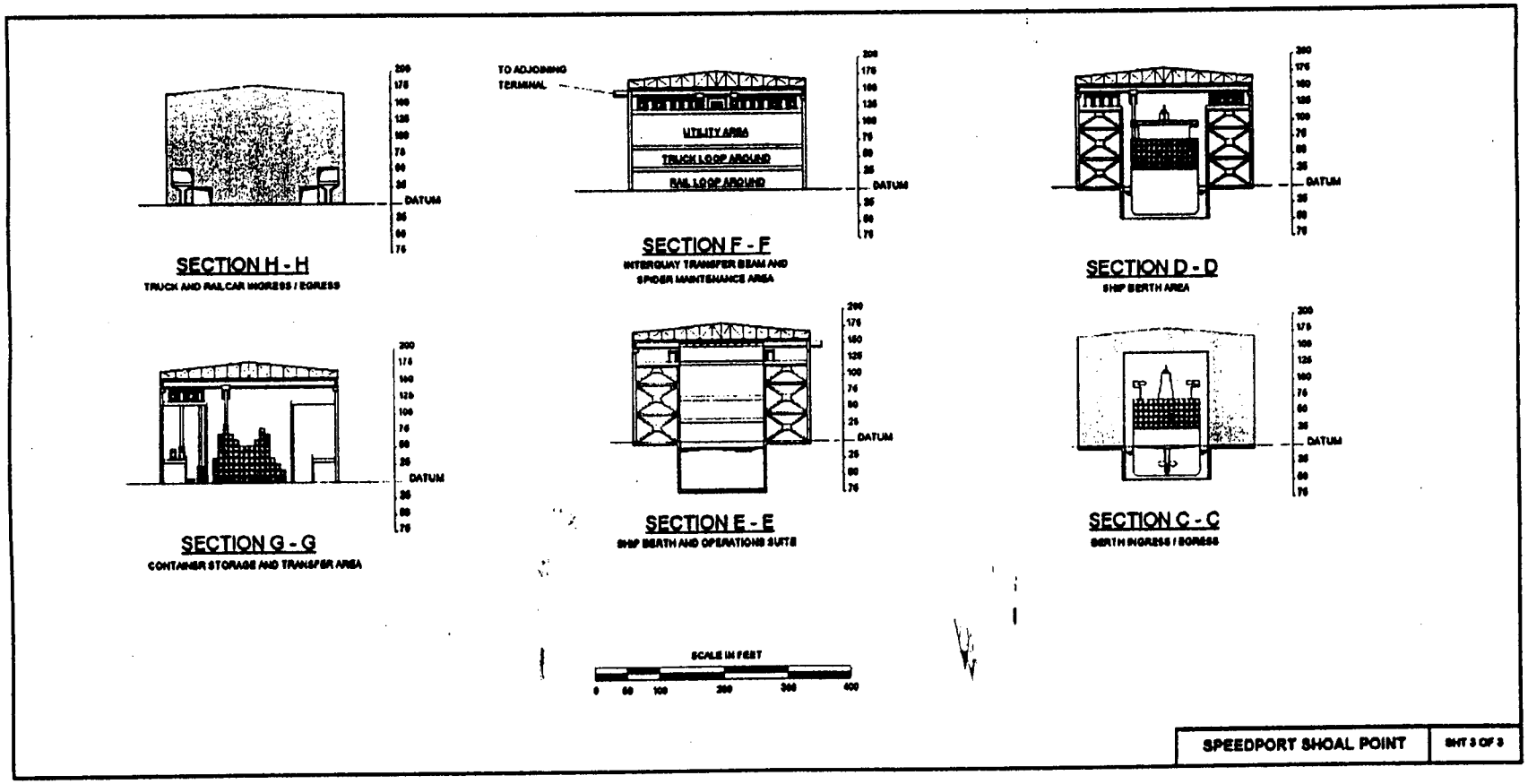


Ledvina, P. Expert Report Figure 3



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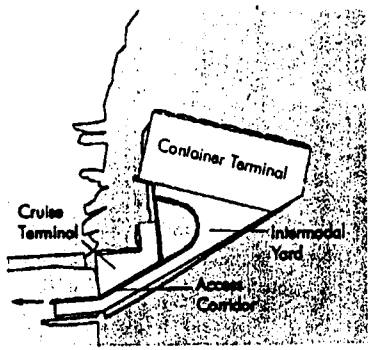
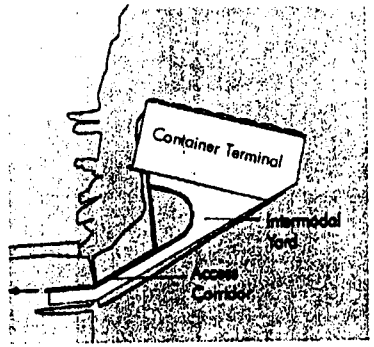
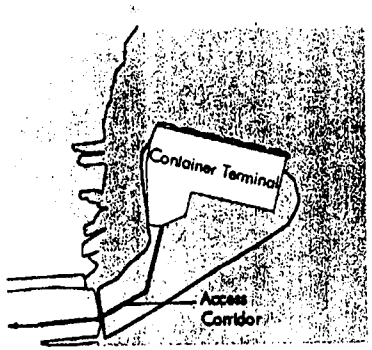


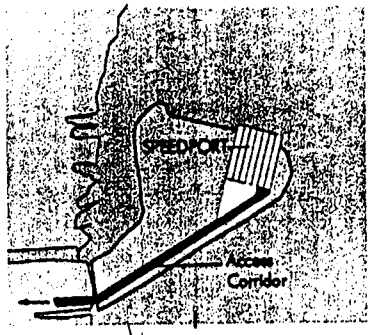
A. Container terminal (7-berth) and cruise terminals laid out as described in DEIS for Bayport.



B. Container terminal (7-berth), without cruise terminal, laid out as described in the DEIS for Bayport.

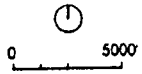


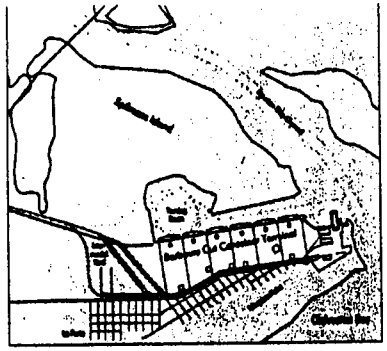
C. Container terminal (6-berth) laid out as described in DEIS for Texas City.



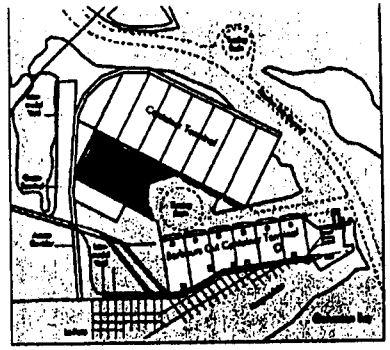
D. SPEEDPORT (7-berth), ACTA Maritime Development Corporation.

Figure 1. Alternative Plans for a Container Terminal at Shoal Point.

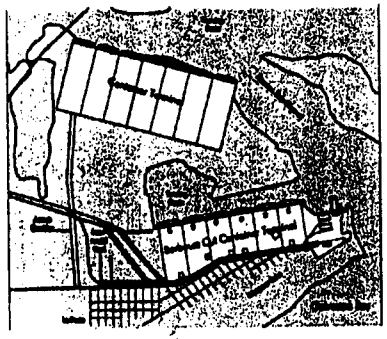




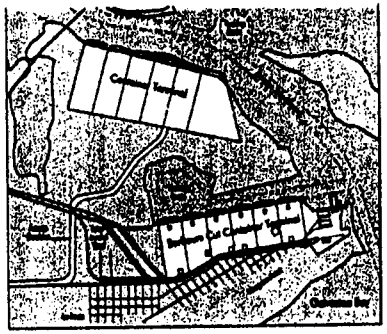
A. No container terminal on Spilmans Island.



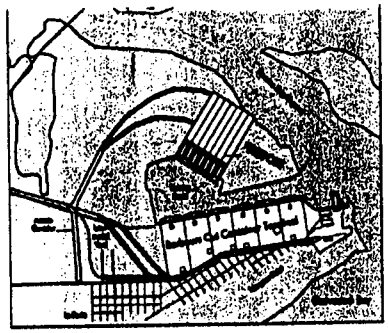
B. Container and cruise terminals laid out as described in the DEIS for Bayport.



C. Container terminal laid out to minimize footprint, dredging, and duplication of infrastructure.



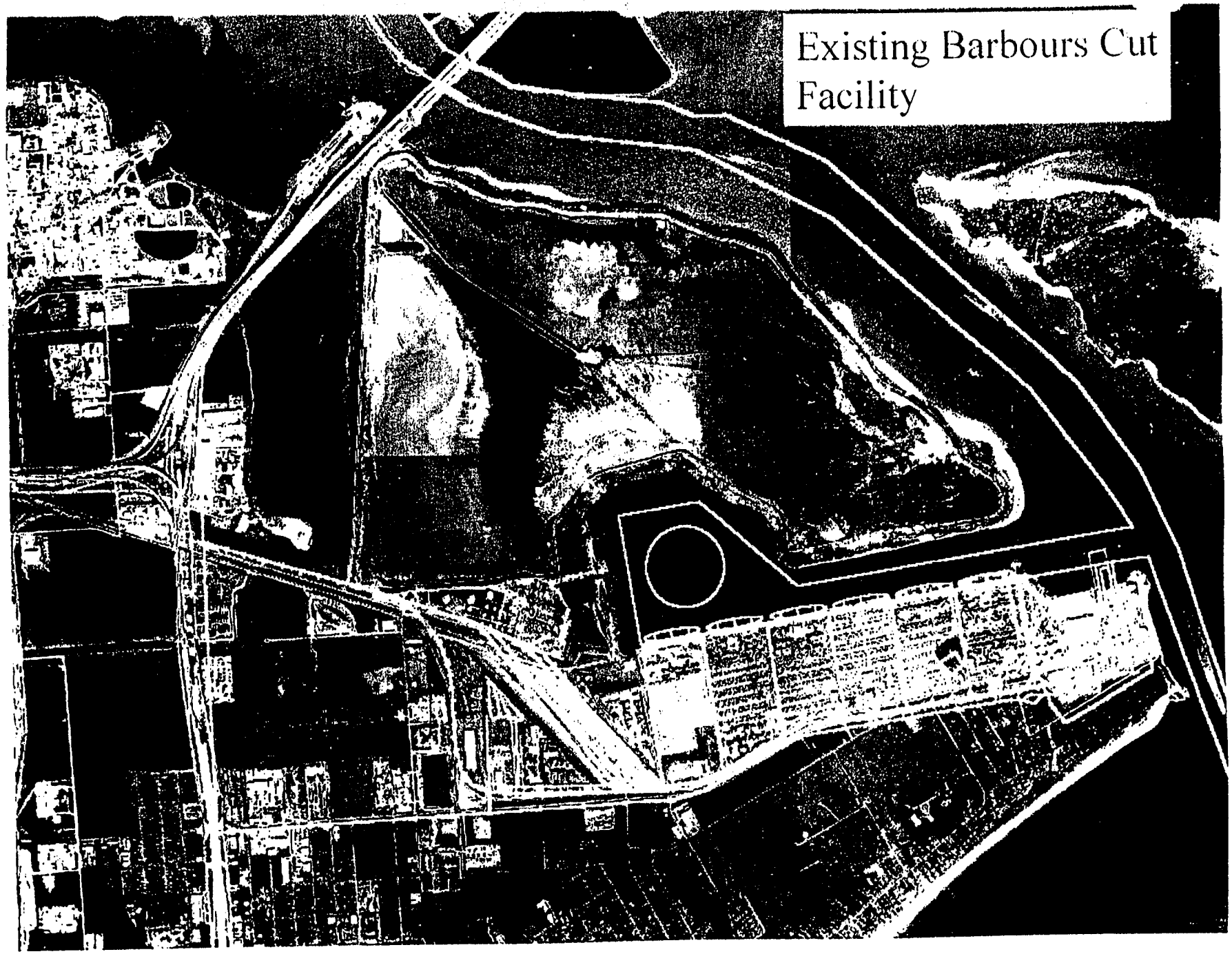
D. Container terminal laid out as described in the DEIS for Texas City.

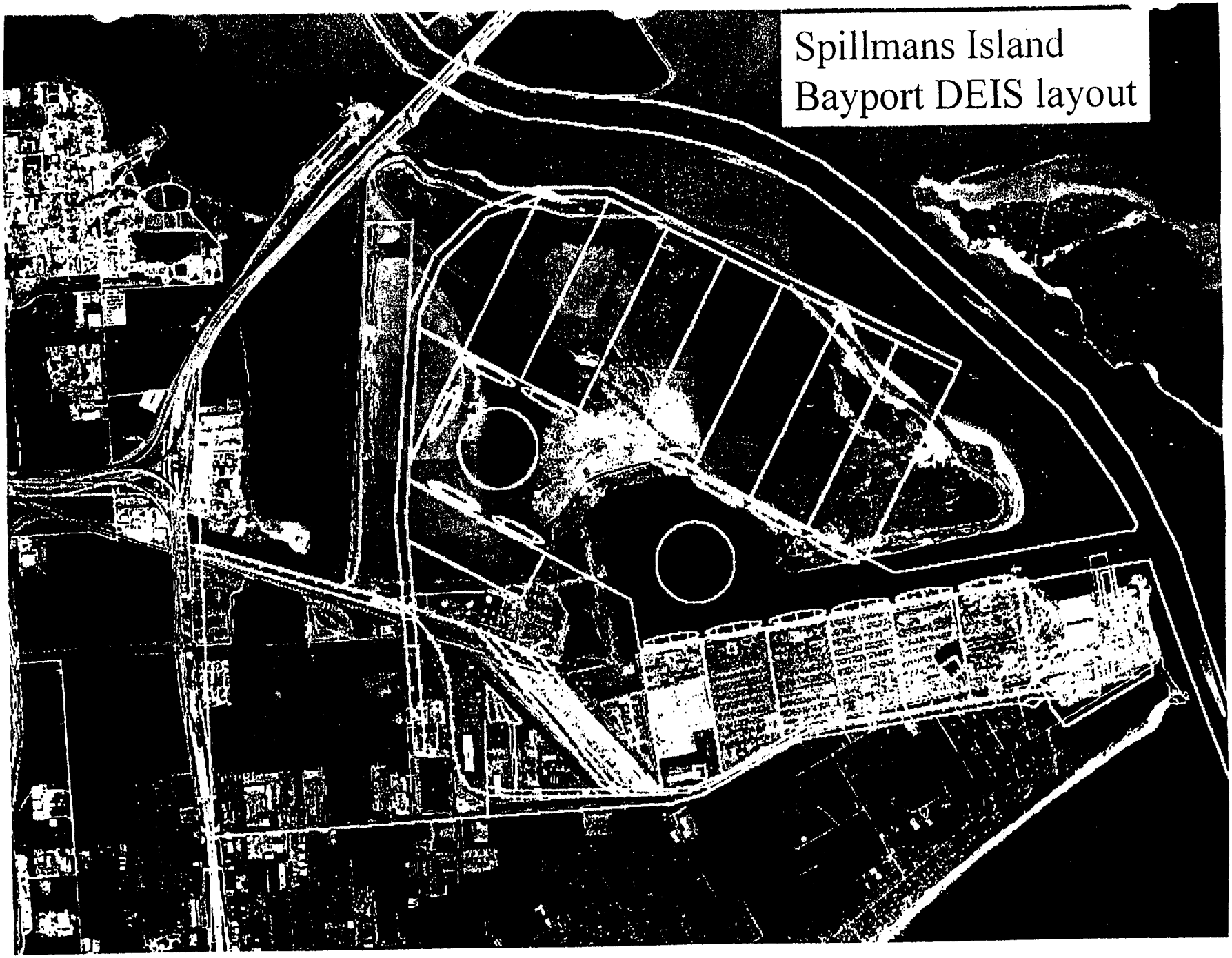


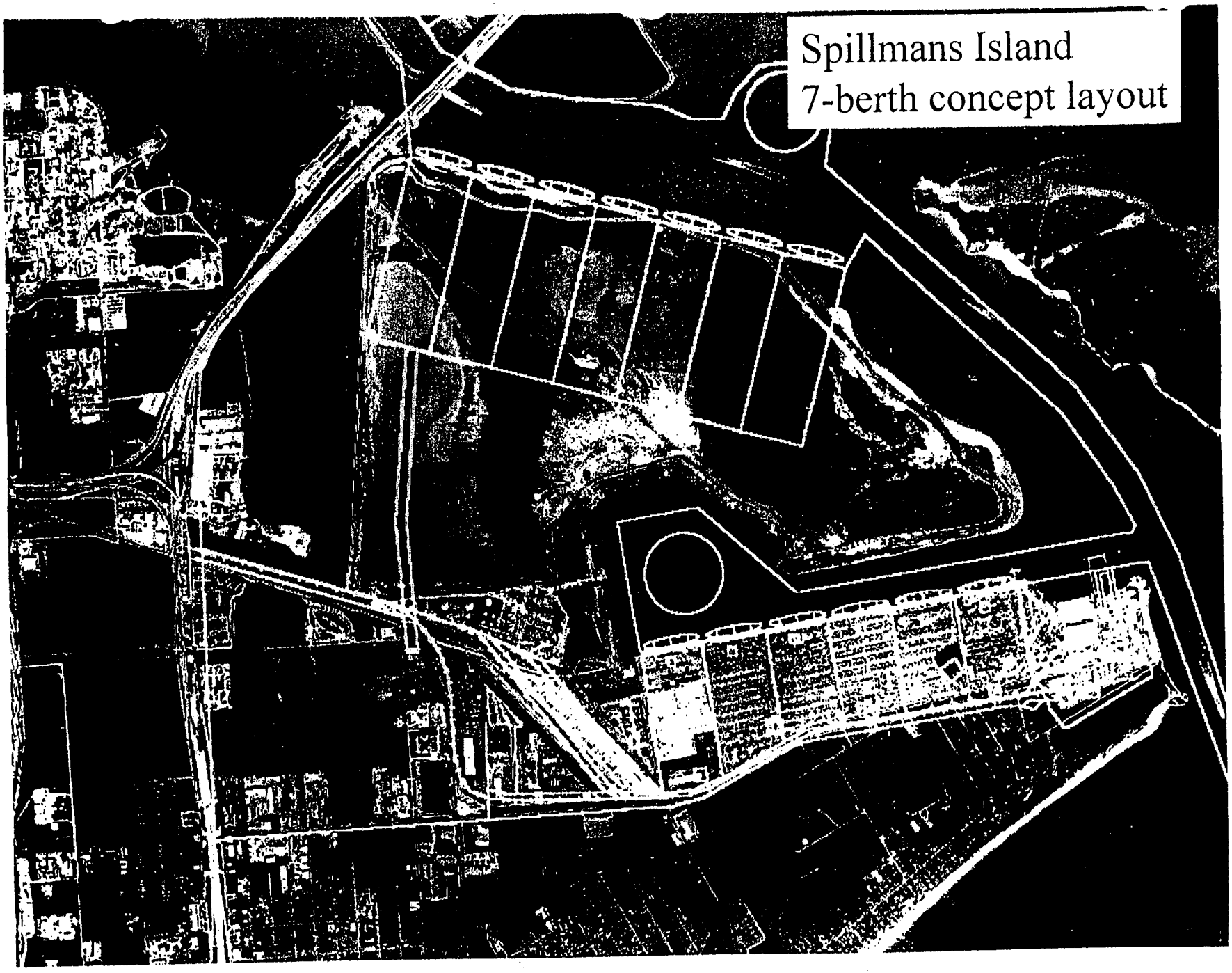
E. SPEEDPORT, ACTA Maritime Development Corporation.

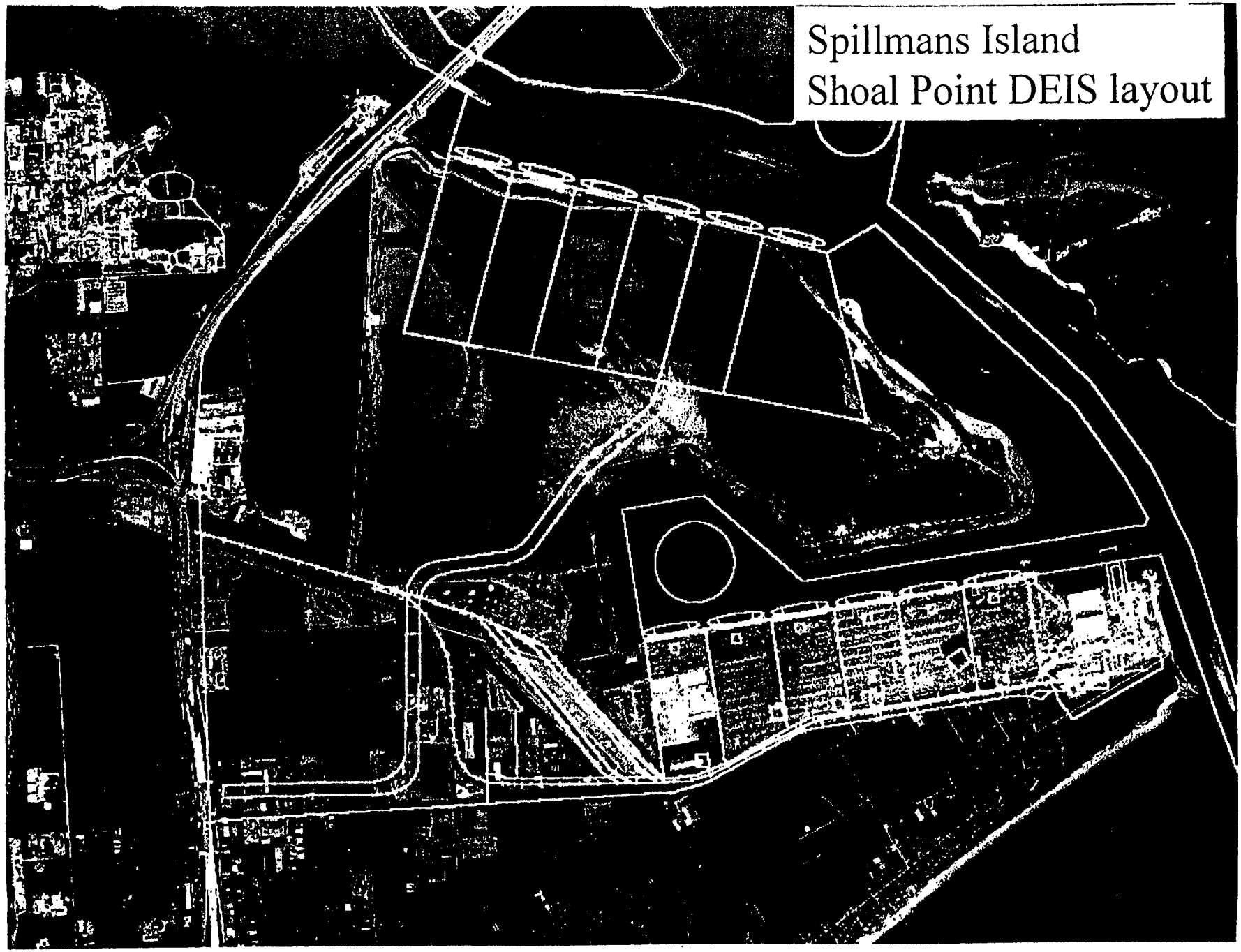
Figure 2. Alternative Plans for a Container Terminal at Spilmans Island

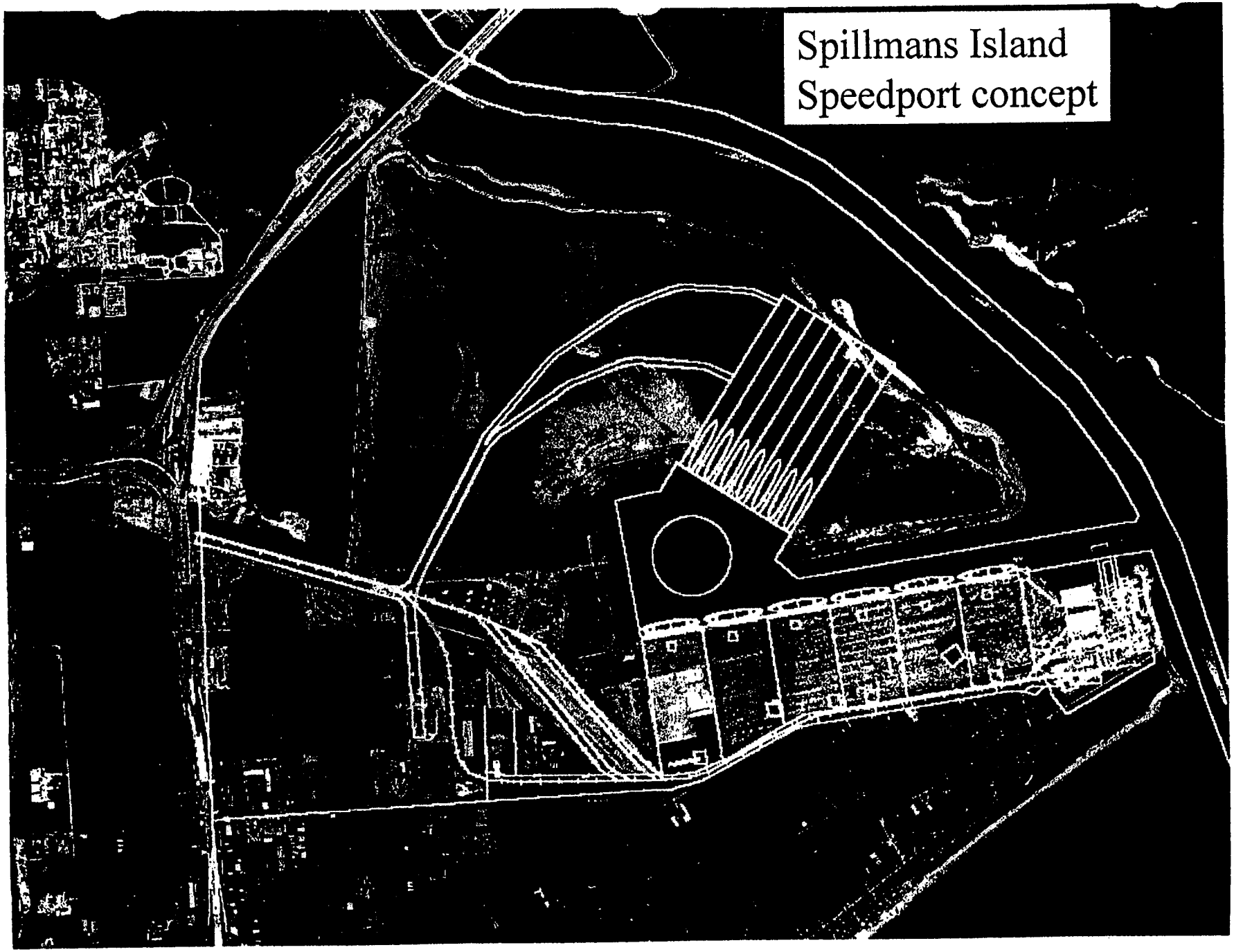
0 5000'

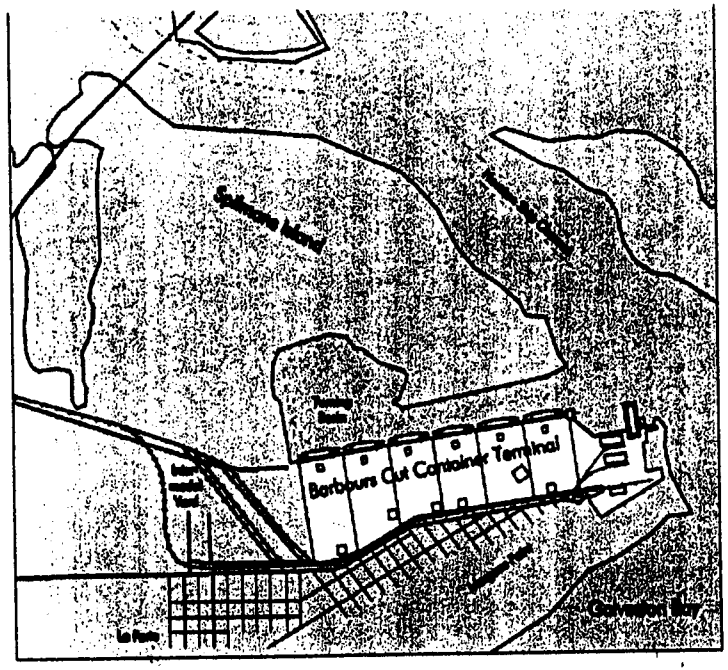

Existing Barbours Cut
Facility


Spillmans Island
Bayport DEIS layout


Spillmans Island
7-berth concept layout

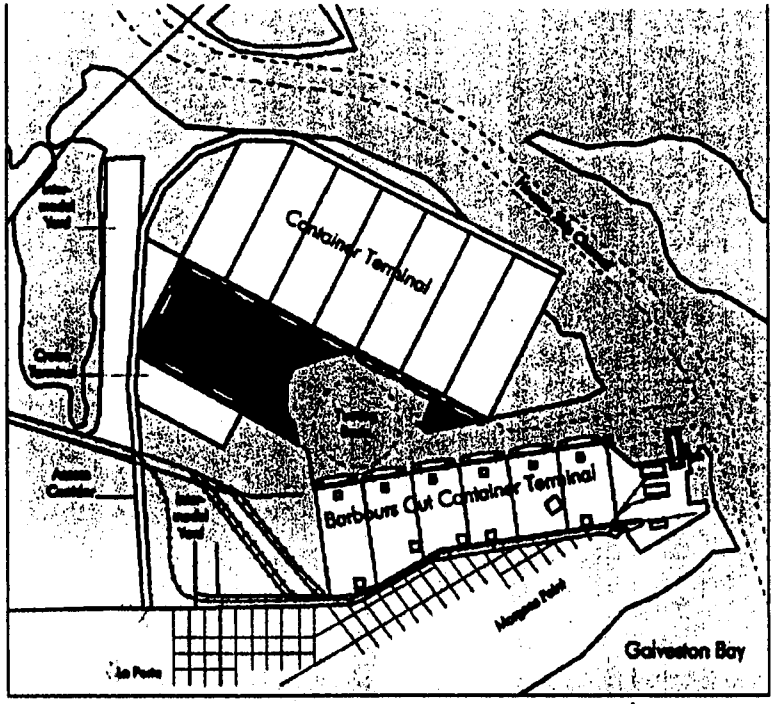

Spillmans Island
Shoal Point DEIS layout


Spillmans Island
Speedport concept



A. No container terminal on Spilmans Island.

0 5000'



B. Container and cruise terminals laid out as described in the DEIS for Bayport.

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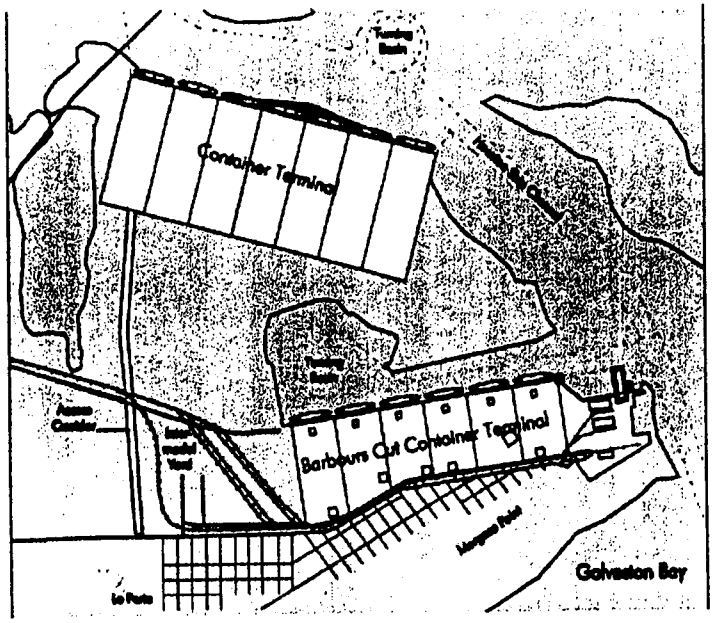
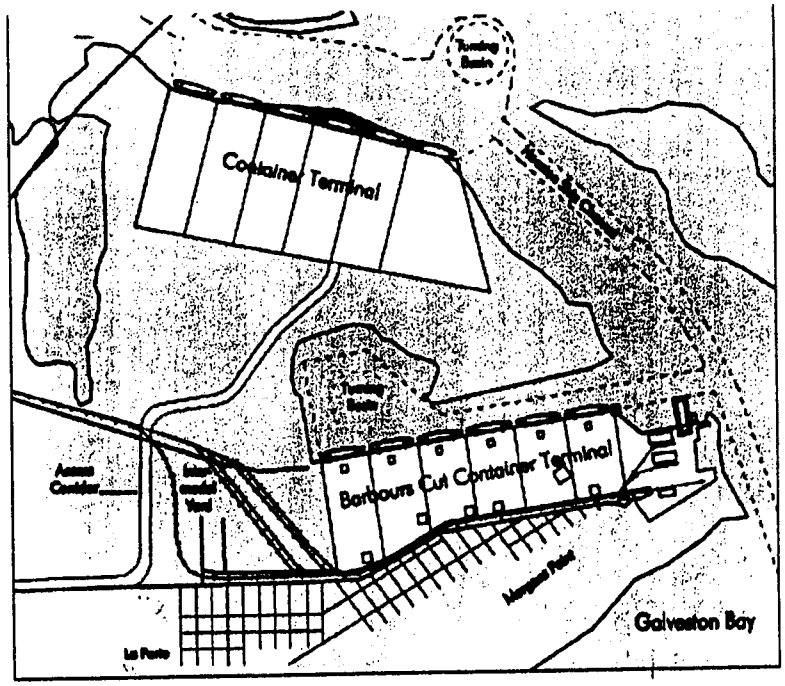


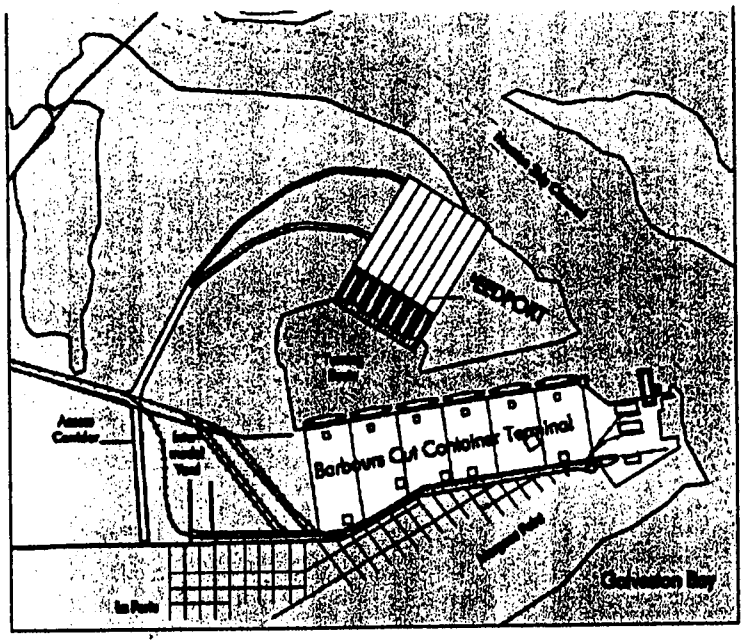
C. Container terminal laid out to minimize footprint, dredging, and duplication of infrastructure.

0 5000'



D. Container terminal laid out as described in the DEIS for Texas City.

0 5000'



E. SPEEDPORT, ACTA Maritime Development Corporation.

0 5000'

Improved Terminal Efficiency - *SPEEDPORT*$_{TM}$, Terminal Design and Operating System for the 21st Century

John O. Arntzen
President, ACTA Maritime Development Corporation

Richard P. Thorsen, P.E.
Chairman, ACTA Maritime Development Corporation

Presented at

Container Handling Automation and Technologies Conference
London, England
February 22-23, 1999

and

Port Financing Conference
Miami, Florida
February 22-23, 1999

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Ledvina, P.
Expert Report

Attachment A

2000 Census population calculations for each alternative site
Bayport DEIS and Shoal Point DEIS

2000 Population Comparison
with footprints from Bayport
and Shoal Point DEIS

		Population		
Site layout		r = 1mi		r = 2mi
Bayport		5,772		13,933
Bayport, SPdeis		3,709		8,518
Spillmans		1,549		6,551
Spilmans, SPdeis		0		2,481
Spilmans, expert pref alt		112		4,085
Shoal Point		419		8,907
Shoal Point, SPdeis		291		8,478
Shoal Point, expert pref alt		419		8,907
SP DEIS - Shoal Point DEIS				
Expert pref alt - 7 berth alternative designed by Ledvina, P.				
r = radius in miles				
Census blocks from year 2000 U.S. Census				
Calculation performed according to method in section I-B				
Files submitted on CD as part of comments				

Ledvina, P.
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Attachment B

Restated version of Bayport DEIS Tables 2-4 and 2-5

RESTATED TABLE 2.4: SUMMARY COMPARISON OF ENVIRONMENTAL CONSEQUENCES OF CONTAINER TERMINALS, AS LAID OUT IN THE DEISs FOR BAYPORT AND TEXAS CITY

Topic	No Action Alternative	Bayport Alternative (as in DEIS for Bayport)	Bayport Alternative (as in DEIS for Texas City)	Spilmans Island Alternative (as in DEIS for Bayport)	Spilmans Island Alternative (as in DEIS for Texas City)	Shoal Point Alternative (as in DEIS for Bayport)	Shoal Point Alternative (as in DEIS for Texas City)

Availability	• The Applicant owns 1,086 acres at the Bayport site that could be made available for of alternative functions	• The Applicant owns 1,086 acres at or near the Bayport site
		• The Applicant would have to replace the existing dredged material placement functions of the area
		• The Applicant would need to acquire an additional 162 acres to develop the proposed facilities at this site
		  • 100 acres of gate facilities planned on land owned by American Acryl
		  • 140 acres of rail yard and access corridor in city of Seabrook would be condemned
			• The Applicant owns 1,086 acres at or near the Bayport site
			• No additional properties would have to be acquired.
			• The Applicant would have to replace the existing dredged material placement functions of the area
				• The Applicant owns this entire site
				• No additional properties would have to be acquired.
				• The Applicant would have to replace the existing dredged material placement functions of the area
				• The Applicant would have to acquire the existing powerline right of way
					• The Applicant owns this entire site
					• No additional properties would have to be acquired.
					• The Applicant would have to replace the existing dredged material placement functions of the area
						• The Applicant owns no property at this location
						• The Applicant would have to acquire property at this site from the Texas City and the owners of the active disposal area
						• The Applicant would have to replace the existing dredged material placement functions of the area
							• The Applicant owns no property at this location
							• The Applicant would have to acquire property at this site from the Texas City and the owners of the active disposal area
							• The Applicant would have to replace the existing dredged material placement functions of the area

Operational Effectiveness	• Does not provide any additional container throughput capacity to the Applicant	• The site could accommodate all the facilities included in the Applicant's Proposed Project
		• The site is located 9 roadway miles from the Barbours Cut Terminal, which increases the costs for hauling containers to intermodal facilities in the early years of development and the long-term transportation cost for empty trucks.
		• The site is located so that rail cargo from the site could be consolidated with that from the Barbours Cut Terminal
		• The site is located 36 sailing miles from the entrance to the HSC
			• The site could accommodate all the facilities included in the Applicant's Proposed Project
			• The site is located 9 roadway miles from the Barbours Cut Terminal, which increases the costs for hauling containers to intermodal facilities and the long-term transportation cost for empty trucks.
			• The site is located so that rail cargo from the site could be consolidated with that from the Barbours Cut Terminal
			• The site is located 36 sailing miles from the entrance to the HSC
				• The site could accommodate all the facilities included in the Applicant's Proposed Project
				• The site is located adjacent to Barbours Cut Terminal which minimizes the costs for hauling containers to intermodal facilities in the early years of development and the long-term transportation cost for empty trucks.
				• The site is located so that rail cargo from the site could be consolidated with that from the Barbours Cut Terminal
				• Proximity to existing Barbours Cut terminal allows for maximum utilization of existing infrastructure
				• The site is located 38 sailing miles from the entrance to the HSC
					• The site could accommodate all the facilities included in the Applicant's Proposed Project
					• The site is located adjacent to Barbours Cut Terminal which minimizes the costs for hauling containers to intermodal facilities in the early years of development and the long-term transportation cost for empty trucks.
					• The site is located so that rail cargo from the site could be consolidated with that from the Barbours Cut Terminal
					• Proximity to existing Barbours Cut terminal allows for maximum utilization of existing infrastructure
					  • Existing intermodal facility may be shared
					  • Existing off-site
						• The site could accommodate all the facilities included in the Applicant's Proposed Project
						• The site is located near the Galveston Terminal which minimizes the costs for hauling containers to intermodal facilities in the early years of development and the long-term transportation cost for empty trucks.
						• The site is located such that rail cargo could be consolidated with that from the Galveston Terminal
						• The site is located 17 sailing miles from the entrance to the HSC
							• The site could accommodate all the facilities included in the Applicant's Proposed Project
							• The site is located near the Galveston Terminal which minimizes the costs for hauling containers to intermodal facilities in the early years of development and the long-term transportation cost for empty trucks.
							• The site is located such that rail cargo could be consolidated with that from the Galveston Terminal
							• The site is located 17 sailing miles from the entrance to the HSC

RESTATED TABLE 2.4: SUMMARY COMPARISON OF ENVIRONMENTAL CONSEQUENCES OF CONTAINER TERMINALS, AS LAID OUT IN THE DEISs FOR BAYPORT AND TEXAS CITY

Topic	No Action Alternative	Bayport Alternative (as in DEIS for Bayport)	Bayport Alternative (as in DEIS for Texas City)	Spilmans Island Alternative (as in DEIS for Bayport)	Spilmans Island Alternative (as in DEIS for Texas City)	Shoal Point Alternative (as in DEIS for Bayport)	Shoal Point Alternative (as in DEIS for Texas City)
				• The site is located 38 sailing miles from the entrance to the HSC	warehouse facilities may be shared • The site is located 38 sailing miles from the entrance to the HSC		
Site Constraints	• There are no constraints to non-development	• No unusual soil improvement would be required for project development at this site • Relocation of Port Road and several pipelines would be required at this site • A new rail line would be required in the latter stages of development • The use of this site would require development of a replacement dredged material placement area or beneficial use site	• No unusual soil improvement would be required for project development at this site • No relocation of Port Road would be required at this site • The use of this site would require development of a replacement dredged material placement area or beneficial use site	• The site is an active dredged material placement area requiring soil improvements • Substantial dredging would be required for the terminal basin • The use of this site would require development of a replacement dredged material placement area or beneficial use site • The existing high-voltage electric transmission lines crossing the site would have to be relocated	• The site is an active dredged material placement area requiring soil improvements • Minimal dredging would be required for the terminal basin • The use of this site would require development of a replacement dredged material placement area or beneficial use site • The existing high-voltage electric transmission lines crossing the site would not have to be relocated	• The site is an active dredged material placement area requiring soil improvements • Minimal dredging would be required for the terminal basin • A new roadway and rail access corridor would have to be constructed to the site. • The use of this site would require development of a replacement dredged material placement area or beneficial use site	• The site is an active dredged material placement area requiring soil improvements • Minimal dredging would be required for the terminal basin • A new roadway access corridor would have to be constructed to the site. • The use of this site would require development of a replacement dredged material placement area or beneficial use site

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Topic	No Action Alternative	Bayport Alternative (as in DEIS for Bayport)	Bayport Alternative (as in DEIS for Texas City)	Spilmans Island Alternative (as in DEIS for Bayport)	Spilmans Island Alternative (as in DEIS for Texas City)	Shoal Point Alternative (as in DEIS for Bayport)	Shoal Point Alternative (as in DEIS for Texas City)

Land Use and Coastal Zone Management	• Non-development of site is consistent with community values	• Land use would change from undeveloped to heavy industrial
		• Land use not consistent with local Master Plans
		• Land use not consistent with community values
		• Some secondary development would occur offsite
		• Cumulative land use impacts likely with proposed San Jacinto Rail
		• Affected CNRAs:
		  • Coastal historic areas
		  • Coastal Wetlands
		  • Oyster reefs
		  • Special Hazard areas
		  • Intertidal sand or mudflats
		  • Water under tidal influence
		  • Submerged lands
			• Land use would change from undeveloped to heavy industrial
			• Land use not consistent with local Master Plans
			• Land use not consistent with community values
			• Some secondary development would occur offsite
			• Some secondary development would occur offsite
			• Cumulative land use impacts likely with proposed San Jacinto Rail
			• Affected CNRAs:
			  • Coastal historic areas
			  • Coastal Wetlands
			  • Oyster reefs
			  • Special Hazard areas
			  • Intertidal sand or mudflats
			  • Water under tidal influence
			  • Submerged lands
				• Land use would change from DMPA to heavy industrial
				• Land use consistent with La Porte land use map and existing uses at Barbours Cut
				• Some secondary development would occur offsite
				• Affected CNRAs:
				  • Coastal historic areas
				  • Oyster reefs
				  • Special Hazard areas
				  • Intertidal sand or mudflats
				  • Water under tidal influence
				  • Submerged lands
					• Land use would change from DMPA to heavy industrial
					• Consistent with La Porte land use map and existing uses at Barbours Cut
					• Some secondary development would occur offsite
					• Affected CNRAs:
					  • Coastal historic areas
					  • Oyster reefs
					  • Special Hazard areas
					  • Intertidal sand or mudflats
					  • Water under tidal influence
					  • Submerged lands
						• Land use would change from DMPA to heavy industrial
						• Consistent with community values in Texas City Vision 2020
						• Some secondary development would occur offsite
						• Affected CNRAs:
						  • Coastal historic areas
						  • Oyster reefs ??not live??
						  • Special Hazard areas
						  • Intertidal sand or mudflats
						  • Water under tidal influence
						  • Submerged lands
							• Land use would change from DMPA to heavy industrial
							• Consistent with community values in Texas City Vision 2020
							• Some secondary development would occur offsite
							• Affected CNRAs:
							  • Coastal historic areas
							  • Oyster reefs ??not live??
							  • Special Hazard areas
							  • Intertidal sand or mudflats
							  • Water under tidal influence
							  • Submerged lands

Socio-economic Environment	• Residential land values will increase throughout neighborhoods of Shoreacres, La Porte, El Jardin, and Seabrook	• 2,847 direct on site jobs to handle 1.4 million containers at build out	• 452 direct on site jobs to handle 1.5 million containers at build out	• 2,847 direct on site jobs to handle 1.4 million containers at build out	• 452 direct on site jobs to handle 1.5 million containers at build out	• 2,847 direct on site jobs to handle 1.4 million containers at build out	• 452 direct on site jobs to handle 1.5 million containers at build out
Social Impacts and Environmental Justice	• No loss of homes for residential purposes	• 143,913 residents affected by cumulative impact within one mile of San Jacinto Rail, including 89,049 Hispanic residents along SH 3 and Griggs Rd • Likely loss of community structure due to direct and cumulative impacts • Direct environmental justice impacts due to rail and truck traffic in east Houston	• 143,913 residents affected by cumulative impact within one mile of San Jacinto Rail, including 89,049 Hispanic residents along SH 3 and Griggs Rd • Possible loss of community structure due to direct and cumulative impacts • Direct environmental justice impacts due to rail and truck traffic in east Houston	• No loss of homes for residential purposes • Direct environmental justice impacts due to rail and truck traffic in east Houston	• No loss of homes for residential purposes • Direct environmental justice impacts due to rail and truck traffic in east Houston	• No loss of homes for residential purposes • Direct environmental justice impacts due to rail and truck traffic in east Houston	• No loss of homes for residential purposes • Direct environmental justice impacts due to rail and truck traffic in east Houston
Surface Transportation	• No impact • SH 146 MIS would require revision if one or	• Would require SH146 enlarged to 6-lane freeway with access roads, yet	• Would require SH146 MIS • Would require Port Rd improvements	• Would require part of SH146 MIS • Widen Broadway St.	• Would require part of SH146 MIS • Would require	• Would require SH146 MIS • Widen SH197 • Grade separation at	• Would require part of SH146 MIS • Widen SH197

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	more currently proposed ports was not constructed	would still produce F or near F LOS at some intersections
		• Requires new rail line(s) to access site and a new marshalling yard
		• Federal or state share of $147M in local grade separation and capacity projects would be required
		• Widen Port Road to 6 lanes
		• Grade separations
		  • SH146 and Port Terminal Railway (PTRA)
		  • Old 146 and PTRA
		  • Fairmont Parkway and PTRA
		  • Choate Road and PTRA
		  • Choate Road and SH146
		  • Port Road and PTRA
		• Flyover ramps
		  • Westbound Port Road to 146 N
		  • 146 S to southern access
		  • 146S to precheck gate
		• Poor level of service
		  • intersection of SH146 and Shoreacres Blvd
		  • intersection of SH146 and Red Bluff Road
				• Modify intersection at Broadway St./Barbours Cut Blvd.
				• Modify intersection at SH146/Barbours Cut Blvd.
				• Grade separated rail crossing at Broadway St.
				• Would use existing rail yard at Barbours Cut
					intersection/interchange modifications
					• Would use existing railyard at Barbours Cut
						SH197/Access Road Intersection
						• Road/rail grade separation at Loop 197
						• Would use existing rail yard to the west
							• Grade separation at SH197/Access Road Intersection
							• Road/rail grade separation at Loop 197
							• Would not send containers to applicant's Barbours Cut facility
							• Would use existing rail yard to the west

Community Infrastructure and Municipal Services	• No impact	• Would not require additional water supply or sanitary wastewater treatment capacity • New water line, wastewater force main, and lift station would be required	• Would not require additional water supply or sanitary wastewater treatment capacity • New water line, wastewater force main, and lift station would be required	• Would not require additional water supply or sanitary wastewater treatment capacity • New water and sewer lines would be required from the existing Houston and Morgan's Point systems • Existing high-voltage power line would have to be relocated	• Would not require additional water supply or sanitary wastewater treatment capacity • New water and sewer lines would be required from the existing Houston and Morgan's Point systems • Existing high-voltage power line would not have to be relocated	• Would not require additional water supply or sanitary wastewater treatment capacity • Construction of new sewer lines would be required to carry wastewater to exiting GCWDA facilities	•
Navigation	• No delays to existing ship traffic due to additional container ship traffic	• Site is 36 miles from, Galveston Harbor sea buoy	• Site is 36 miles from, Galveston Harbor sea buoy	• Site is 38 miles from, Galveston Harbor sea buoy	• Site is 38 miles from, Galveston Harbor sea buoy	• Site is 17 miles from Galveston Harbor sea buoy	• Site is 17 miles from Galveston Harbor sea buoy

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		• Terminal located along Bayport Ship Channel (-40 MLT) which joins a section of the Houston Ship Channel that is soon to be maintained to –45 ft MLT. Existing Channel is 3.6 miles long by 400 ft in width
		• (7-berth conditions) Delays to existing ship traffic due to additional container ship traffic assuming a 45% increase in non-containership traffic
		  • over 1000 delays per year, averaging 60 minutes a delay, to non-containership traffic at full build-out
		  • An average delay cost per day of $250 to over $400 per non-containership, and $1,200 to over $1,400 per container ship, significantly weakening project economics
		• A potential exists for conflicts between commercial vessels and recreational boats
			• Terminal located along Bayport Ship Channel (-40 MLT) which joins a section of the Houston Ship Channel that is soon to be maintained to –45 ft MLT. Existing Channel is 3.6 miles long by 400 ft in width
			• (6 berth conditions) Delays to existing ship traffic due to additional container ship traffic assuming a 45% increase in non-containership traffic
			  • The average delay time per day would increase from 3 minutes (existing conditions) to 63 minutes (phase III)
			  • estimate of average delay cost per day for non-containership traffic increasing from about $40 (existing conditions) to $400 (phase III), and $72 (phase I) to $1400 (phase III) for container ship traffic
			• A potential exists for conflicts between commercial vessels and recreational boats
				• Terminal located along Barbours Cut Ship Channel which joins a section of the Houston Ship Channel that is soon to be maintained to –45 ft MLT.
				• Minimum potential exists for conflicts between commercial vessels and recreational boats
				• Significant delay to existing container ship traffic because access to site is through Barbours Cut Channel
				• Minimum potential exists for conflicts between commercial vessels and recreational boats
					• Terminal located along the Houston Ship Channel that is soon to be maintained to –45 ft MLT.
					• Minimum potential exists for conflicts between commercial vessels and recreational boats
					• Minimal delay to existing container ship traffic because access to site is not through Barbours Cut Channel
					• Minimum potential exists for conflicts between commercial vessels and recreational boats
						• Terminal located south of Texas City Channel (currently maintained to –40 MLT). Existing channel is 6.8 miles long by 400 ft wide
						• (7-berth conditions) Delays to existing ship traffic due to additional container ship traffic assuming a 45% increase in non-containership traffic
						  • The average delay time per day would increase from 10 minutes (existing conditions) to more than 122 minutes at 7 berths (phase III)
						  • Estimate of average delay cost per day for non-containership traffic increasing from about $604 (existing conditions) to $1942(phase III), and $227(phase I) to $2751 (phase III) for container ship traffic
						• Minimum potential exists for conflicts between commercial vessels and recreational boats
							• Terminal located south of Texas City Channel (currently maintained to –40 MLT). Existing channel is 6.8 miles long by 400 ft wide
							• (6 berth conditions) Delays to existing ship traffic due to additional container ship traffic assuming a 45% increase in non-containership traffic
							  • The average delay time per day would increase from 10 minutes (existing conditions) to 122 minutes (phase III)
							  • Estimate of average delay cost per day for non-containership traffic increasing from about $604 (existing conditions) to $1942(phase III), and $227(phase I) to $2751 (phase III) for container ship traffic
							• Minimum potential exists for conflicts between commercial vessels and recreational boats

Noise	• No impact	• Noise will exceed the residential standard of 54 Ldn established by the City of La Porte • Noise will exceed levels allowable under ordinances of Seabrook, Shoreacres and LaPorte and the EPA recommended criteria of 55 Ldn • Noise levels will exceed 65 Ldn north of the channel in LaPorte and Shoreacres and areas of	• Residential neighborhoods will experience noise levels that exceed the residential standard of 54 Ldn	• Residential neighborhoods will experience little increase in noise above existing levels from Barbours Cut	• Residential neighborhoods will experience little increase in noise above existing levels from Barbours Cut	• Residential neighborhoods will experience no adverse noise impacts	• Residential neighborhoods will experience no adverse noise impacts

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		El Jardin and Seabrook • Noise levels between 60 and 65 reach far into El Jardin and Seabrook					
Aesthetics and Light	• No impact	• Residential areas in close proximity north, southeast, south, and southwest of the site will be impacted by view of cranes and container stacks	• Residential areas in close proximity north, southeast, south, and southwest of the site will be impacted by view of cranes and container stacks	• Residential areas will not be significantly impacted beyond existing view of Barbours Cut	• Residential areas will not be significantly impacted beyond existing view of Barbours Cut	• Residential areas will be impacted by view of cranes and container stacks	• Residential areas will be impacted by view of cranes and container stacks
Cultural Resources	• No impact	• Would directly impact sites 41Hr881, 41Hr832, and 41Hr833 which have been determined ineligible for listing in the NRHP	• Would directly impact sites 41Hr832, and 41Hr833 which have been determined ineligible for listing in the NRHP	• No impact	• No impact	• Could potentially impact underwater archeological site 41Gv81	• Could potentially impact underwater archeological site 41Gv81
Parks and Recreation	• The recreational value of bay waters will be preserved	• The recreational value of bay waters will be impacted by • wildlife habitat loss • more relative to sites that are dredge material placement areas • more relative to terminals with smaller footprints • short and long term water quality degradation • more loss of biological filtering relative to dredge spoil sites • more loss of biological filtering relative to terminals with smaller footprints • the foreseeable increase in the introduction of non-indigenous species (more because of greater distance to gulf) • increased vessel traffic, beyond "voluntary displacement" (more because of greater distance to gulf) • increased noise and light, and aesthetic	• The recreational value of bay waters will be impacted by • wildlife habitat loss • more relative to sites that are dredge material placement areas • less relative to terminals with larger footprints • short and long term water quality degradation • more loss of biological filtering relative to dredge spoil sites • less loss of biological filtering relative to terminals with larger footprints • the foreseeable increase in the introduction of non-indigenous species (more because of greater distance to gulf) • increased vessel traffic, beyond "voluntary displacement" (more because of greater distance to gulf) • increased noise and light, and aesthetic	• The recreational value of bay waters will be impacted by • wildlife habitat loss • less relative to sites that are not dredge material placement areas • more relative to terminals with smaller footprints • short and long term water quality degradation • less loss of biological filtering because site is a dredge spoil area • more loss of biological filtering relative to terminals with smaller footprints • the foreseeable increase in the introduction of non-indigenous species (more because of greater distance to gulf) • increased vessel traffic, beyond "voluntary displacement" (more because of greater distance to gulf) • increased noise and light, and aesthetic	• The recreational value of bay waters will be impacted by • wildlife habitat loss • less relative to sites that are not dredge material placement areas • less relative to terminals with larger footprints • short and long term water quality degradation • less loss of biological filtering because site is a dredge spoil area • less loss of biological filtering relative to terminals with larger footprints • the foreseeable increase in the introduction of non-indigenous species (more because of greater distance to gulf) • increased vessel traffic, beyond "voluntary displacement" (more because of greater distance to gulf) • increased noise and light, and aesthetic	• The recreational value of bay waters will be impacted by • wildlife habitat loss • less relative to sites that are not dredge material placement areas • more relative to terminals with smaller footprints • short and long term water quality degradation • less loss of biological filtering because site is a dredge spoil area • more loss of biological filtering relative to terminals with smaller footprints • the foreseeable increase in the introduction of non-indigenous species (less because of shorter distance to gulf) • increased vessel traffic, beyond "voluntary displacement" (less because of shorter distance to gulf) • increased noise and light, and aesthetic	• The recreational value of bay waters will be impacted by • wildlife habitat loss • less relative to sites that are not dredge material placement areas • less relative to terminals with larger footprints • short and long term water quality degradation • less loss of biological filtering because site is a dredge spoil area • less loss of biological filtering relative to terminals with larger footprints • the foreseeable increase in the introduction of non-indigenous species (less because of shorter distance to gulf) • increased vessel traffic, beyond "voluntary displacement" (less because of shorter distance to gulf) • increased noise and light, and aesthetic

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		degradation (more because of close proximity to residential areas) • increased air pollution in the vicinity of the site (more because of close proximity to residential areas)	degradation (more because of close proximity to residential areas) • increased air pollution in the vicinity of the site (more because of close proximity to residential areas)	degradation (less because of greater distance to residential areas) • increased air pollution in the vicinity of the site (less because of greater distance to residential areas)	degradation (less because of greater distance to residential areas) • increased air pollution in the vicinity of the site (less because of greater distance to residential areas)	degradation (less because of greater distance to residential areas) • increased air pollution in the vicinity of the site (less because of greater distance to residential areas)	degradation (less because of greater distance to residential areas) • increased air pollution in the vicinity of the site (less because of greater distance to residential areas)
Air Quality	• For PM10 Houston-Galveston Area exceeds the 24-hr standard and is just under the annual standard • For PM2.5 Houston-Galveston Area is very close to exceeding the annual average level of 15 micrograms per cubic meter • Many hazardous pollutants are emitted by refineries and petrochemical plants in region	• Emissions from the container, cruise and rail facilities will add more than 245 tons per year of PM10 to a region where the 24-hr standard has already been exceeded and the annual standard is just barely being met • Emissions from the container, cruise and rail facilities will add more PM2.5 to a region that is very close to exceeding the annual average level of 15 micrograms per cubic meter • High PM10 and PM2.5 emissions are extremely critical because of close proximity to residential neighborhoods • Many residential neighborhoods will experience increased exposure to hazardous pollutants known to be in diesel emissions • Conformity emissions will almost certainly exceed 25 tons per day of NOx	• Emissions from the container, cruise and rail facilities will add more than 245 tons per year of PM10 to a region where the 24-hr standard has already been exceeded and the annual standard is just barely being met • Emissions from the container, cruise and rail facilities will add more PM2.5 to a region that is very close to exceeding the annual average level of 15 micrograms per cubic meter • High PM10 and PM2.5 emissions are extremely critical because of close proximity to residential neighborhoods • Many residential neighborhoods will experience increased exposure to hazardous pollutants known to be in diesel emissions • Conformity emissions exceed 25 tons per day of NOx	• Emissions from the container, cruise and rail facilities will add more than 245 tons per year of PM10 to a region where the 24-hr standard has already been exceeded and the annual standard is just barely being met • Emissions from the container, cruise and rail facilities will add more PM2.5 to a region that is very close to exceeding the annual average level of 15 micrograms per cubic meter • High PM10 and PM2.5 emissions are less critical because of greater distance to residential neighborhoods • Few residential neighborhoods will experience increased exposure to hazardous pollutants known to be in diesel emissions • Conformity emissions will almost certainly exceed 25 tons per day of NOx	• Emissions from the container, cruise and rail facilities will add more than 245 tons per year of PM10 to a region where the 24-hr standard has already been exceeded and the annual standard is just barely being met • Emissions from the container, cruise and rail facilities will add more PM2.5 to a region that is very close to exceeding the annual average level of 15 micrograms per cubic meter • High PM10 and PM2.5 emissions are less critical because of greater distance to residential neighborhoods • Few residential neighborhoods will experience increased exposure to hazardous pollutants known to be in diesel emissions • Conformity emissions exceed 25 tons per day of NOx	• Emissions from the container, cruise and rail facilities will add more than 245 tons per year of PM10 to a region where the 24-hr standard has already been exceeded and the annual standard is just barely being met • Emissions from the container, cruise and rail facilities will add more PM2.5 to a region that is very close to exceeding the annual average level of 15 micrograms per cubic meter • High PM10 and PM2.5 emissions are less critical because of greater distance to residential neighborhoods • Few residential neighborhoods will experience increased exposure to hazardous pollutants known to be in diesel emissions • Conformity emissions will almost certainly exceed 25 tons per day of NOx	• Emissions from the container, cruise and rail facilities will add more than 245 tons per year of PM10 to a region where the 24-hr standard has already been exceeded and the annual standard is just barely being met • Emissions from the container, cruise and rail facilities will add more PM2.5 to a region that is very close to exceeding the annual average level of 15 micrograms per cubic meter • High PM10 and PM2.5 emissions are less critical because of greater distance to residential neighborhoods • Few residential neighborhoods will experience increased exposure to hazardous pollutants known to be in diesel emissions • Conformity emissions exceed 25 tons per day of NOx
Public Safety	• No impact	• Greater risk due to proximity to residential area	• Greater risk due to proximity to residential area	• Less risk due to distance from residential area	• Less risk due to distance from residential area	• Less risk due to distance from residential area	• Less risk due to distance from residential area
Hazardous Material	• No impact	• Greater risk due to proximity to residential area	• Greater risk due to proximity to residential area	• Less risk due to distance from residential area	• Less risk due to distance from residential area	• Less risk due to distance from residential area	• Less risk due to distance from residential area
Shoreline	• Continued erosion south	• Unarmored shorelines will	• Unarmored shorelines will	• Unarmored shorelines will	• Unarmored shorelines will	• Unarmored shorelines will	• Unarmored shorelines will

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Erosion	of the Bayport Channel anticipated • Continued southward deposition of sand anticipated	be impacted by longer route (36 mi) to site from Galveston Harbor sea buoy • Severe erosion south of the Bayport Channel anticipated • Continued interruption of southward deposition of sand anticipated with wider and deeper Bayport Channel	be impacted by longer route (36 mi) to site from Galveston Harbor sea buoy • Severe erosion south of the Bayport Channel anticipated • Continued interruption of southward deposition of sand anticipated with wider and deeper Bayport Channel	be impacted by longer route (38 mi) to site from Galveston Harbor sea buoy	be impacted by longer route (38 mi) to site from Galveston Harbor sea buoy	be minimally impacted by shorter route (17 mi) to site from Galveston Harbor sea buoy	be minimally impacted by shorter route (17 mi) to site from Galveston Harbor sea buoy
Hydrology Drainage and Floodplains	• Affected water bodies: • Bayport Ship Channel, Pine Gully, Upper Galveston Bay • About 982 acres of undeveloped land would remain unpaved	• Affected water bodies: • Bayport Ship Channel, Pine Gully, Upper Galveston Bay • About 982 acres of undeveloped land would be paved • About 7% within 100 yr floodplain, about 93% above 100-yr floodplain, and about 13% above 500-yr floodplain	• Affected water bodies: • Bayport Ship Channel, Pine Gully, Upper Galveston Bay • About 467 acres of undeveloped land would be paved	• Affected water bodies: • Houston Ship Channel, Barbours Cut, Lower San Jacinto Bay • About 919 acres of dredged material disposal area would change to paved areas • 90% of facility beneath 100 yr floodplain • Dredge spoil placement will continue throughout phased construction to elevate site	• Affected water bodies: • Houston Ship Channel, Barbours Cut, Lower San Jacinto Bay • About 467 acres of dredged material disposal area would change to paved areas • 90% of facility beneath 100 yr floodplain • Dredge spoil placement will continue throughout phased construction to elevate site	• Affected water bodies: • Texas City Channel , Galveston Bay • About 719 acres of dredged material disposal area would change to paved areas • 98% of facility beneath 100 yr floodplain • Dredge spoil placement will continue throughout phased construction to elevate site	• Affected water bodies: • Houston Ship Channel, Barbours Cut, Lower San Jacinto Bay • About 467 acres of dredged material disposal area would change to paved areas • 98% of facility beneath 100 yr floodplain • Dredge spoil placement will continue throughout phased construction to elevate site
Water Quality	• No impact	• Additional direct impact • Loss of environmental value from wetland filling • Increased salinity as a result of deepening ship channel to > 50 feet	• Additional direct impact • Loss of environmental value from wetland filling • Increased salinity as a result of deepening ship channel to > 50 feet	• Additional direct impact • Increased salinity as a result of deepening ship channel to > 50 feet	• Additional direct impact • Increased salinity as a result of deepening ship channel to > 50 feet	• Additional direct impact • Texas City ship channel already authorized for 50-foot depth	• Additional direct impact • Texas City ship channel already authorized for 50-foot depth
Sediments & Dredged Material	• No impact	• 150.3 submerged acres dredged for facility • 23.5 submerged acres filled for facility	• 58.5 submerged acres dredged for facility • 174.5 submerged acres dredged for deeper ship channel	• 44 submerged acres dredged for facility • 0 submerged acres filled for facility	• 52.5 submerged acres dredged for facility • 58.2 submerged acres dredged for deeper ship channel	• 171 submerged acres dredged for facility • 58 submerged acres filled for facility	• 123.6 submerged acres dredged for facility • 363.6 submerged acres dredged for deeper ship channel
Jurisdictional Wetlands	• No impact	• At least 45.6 acres of jurisdictional wetlands would be impacted • At least 118 acres of total wetlands, field verified	• 3 or more acres of jurisdictional wetlands would be impacted • Approximately 30-50 acres of total wetlands exist in the area impacted by the footprint	• 3 acres of jurisdictional wetlands would be impacted • DMPA not considered part of total wetlands	• 3 acres of jurisdictional wetlands would be impacted • DMPA not considered part of total wetlands	• 13 acres of jurisdictional wetlands would be impacted • DMPA not considered part of total wetlands	• 13 acres of jurisdictional wetlands would be impacted • DMPA not considered part of total wetlands
Ecology	• No project-related impacts on oyster reefs • No project-related loss of Essential Fish Habitat • There would be no	• Live oyster reefs in this area would be affected by increased turbidity associated with dredging • Negative impacts could	• Live oyster reefs in this area would be affected by increased turbidity associated with dredging • Negative impacts could	• Live oyster reefs in this area would be affected by increased turbidity associated with dredging • Negative impacts could	• Live oyster reefs in this area would be affected by increased turbidity associated with dredging • Negative impacts could	• No live oyster reefs in the vicinity • Negative impacts could occur to species for which Galveston Bay has been	• No live oyster reefs in the vicinity • Negative impacts could occur to species for which Galveston Bay has been

RESTATED TABLE 2.5: CORRECTED SUMMARY COMPARISON OF ENVIRONMENTAL CONSEQUENCES OF CONTAINER TERMINALS, AS LAID OUT IN THE DEISs FOR BAYPORT AND TEXAS CITY

Topic	No Action Alternative	Bayport Alternative (as in DEIS for Bayport)	Bayport Alternative (as in DEIS for Texas City)	Spilmans Island Alternative (as in DEIS for Bayport)	Spilmans Island Alternative (as in DEIS for Texas City)	Shoal Point Alternative (as in DEIS for Bayport)	Shoal Point Alternative (as in DEIS for Texas City)
	increased ship traffic to increase the potential for spills toxic to wildlife • No increase in the potential for the introduction of non-indigenous species through the release of ballast water from container ships • No impact would necessarily occur to upland habitat	occur to species for which Galveston Bay has been designated as Essential Fish Habitat • Loss of freshwater wetlands would result in loss of habitat to water fowl and other wildlife • Increased ship traffic increases the potential for spills toxic to wildlife • Increased potential for the introduction of non-indigenous species through the release of ballast water from container ships • Loss of upland habitat for neo-tropical migratory birds	occur to species for which Galveston Bay has been designated as Essential Fish Habitat • Smaller footprint would decrease loss of freshwater wetlands and would result in less loss of habitat to water fowl and other wildlife • Increased ship traffic increases the potential for spills toxic to wildlife • Some loss of upland habitat for neo-tropical migratory birds	occur to species for which Galveston Bay has been designated as Essential Fish Habitat • No freshwater habitats occur within or near this site • Increased ship traffic increases the potential for spills toxic to wildlife	occur to species for which Galveston Bay has been designated as Essential Fish Habitat • No freshwater habitats occur within or near this site • Increased ship traffic increases the potential for spills toxic to wildlife	designated as Essential Fish Habitat • Freshwater ponds lie within this area and would probably be filled during construction which would result in loss of habitat to water fowl and other wildlife • Increased ship traffic increases the potential for spills toxic to wildlife	designated as Essential Fish Habitat • Smaller footprint would decrease loss of freshwater wetlands and would result in less loss of habitat to water fowl and other wildlife • Increased ship traffic increases the potential for spills toxic to wildlife

Improved Terminal Efficiency - *SPEEDPORT*$_{TM}$, Terminal Design and Operating System for the 21st Century

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Chairman, ACTA Maritime Development Corporation

Presented at

Container Handling Automation and Technologies Conference
London, England
February 22-23, 1999

and

Port Financing Conference
Miami, Florida
February 22-23, 1999

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Richard P. Thorsen, P.E., Chairman, ACTA Maritime Development Corp.

Introduction

Global growth in container traffic is projected at a rate of 8% per year for the next 20 years. In 1994, world wide container throughput was 125 million TEUs. By the year 2005, it is anticipated that 275 million TEUs will be moved globally. This growth is caused by the overall increase in world trade and the continued increasing trend of shippers to package general cargoes in containers. In 1995, 410 million tons of containerized cargo moved throughout the world. This equates to 55% of the total 750 million tons general cargo moved that year. By the year 2010, it is expected that 800 million tons, or 92% of the 870 million tons of general cargo that will be transported, will be moved in containers.

All ports wishing to maintain their market share will have to upgrade their facilities. This is especially true for those ports competing for the "hub port" role in their region. Successful ports will have as their goals, dramatic increases in container throughput and decreased cost per unit handled.

Status of the Industry

Over the past 40 years tremendous strides have been made in the improvement of marine container terminal design and operating efficiency. Configurations comprised of various container storage arrangements have maximized throughput capability of the terminals. Dual hoist post-panamax gantry cranes, making use of automated hoist systems, have increased the number of lifts possible to record levels. Intra-terminal container handling equipment has evolved as well. In-yard transfer vehicles, chassis, Automated Ground Vehicles, Rubber Tyred Gantries, and straddle carriers are now nearing the peak of achievable efficiency. More automation will be forthcoming in the next few years to remove the final variable, labor, in the container handling process.

Yet, as we look to the future, we can see that only marginal productivity improvements are left in the conventional container terminal design. As the number of lifts per hour is limited by the number of gantry cranes servicing the ship, the physical constraints of the plant will limit the capacity of all variations of gantry crane based terminal designs.

The numbers of containers carried on the mega-ships of the future will overwhelm a terminal designed in conformance with today's paradigm of single or two sided berths employing conventional gantry cranes. As ports plan to accommodate the envisioned 10,000+ TEU ships of the future, they cannot continue to rely on minor modifications and extensions of their existing physical plants. (Typical port improvement plans usually include increasing terminal acreage and employing more standard gantry type cranes and ancillary container handling equipment.) Even with these improvements, an inordinate amount of time will be required to work cargo and service large ships in these facilities. The drive to minimize downtime in port will cause carriers to demand alternative

terminal designs. Likewise, ports themselves will be in competition for the traffic of the major shipping alliances. The port offering the fastest, safest service at the lowest cost overall will attract the container traffic.

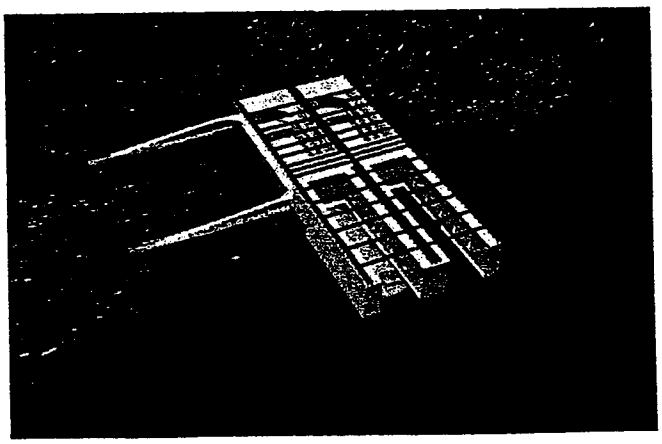
The Challenge of On-Dock Rail

One of the keys to improved throughput capacity in a terminal is the ability to move containers seamlessly onto double-stacked railcars for transport directly into the continental interior. Traditional terminal designs have struggled to find a method by which trains can be safely introduced into the waterfront without disrupting the intra-yard traffic flow of containers and personnel.

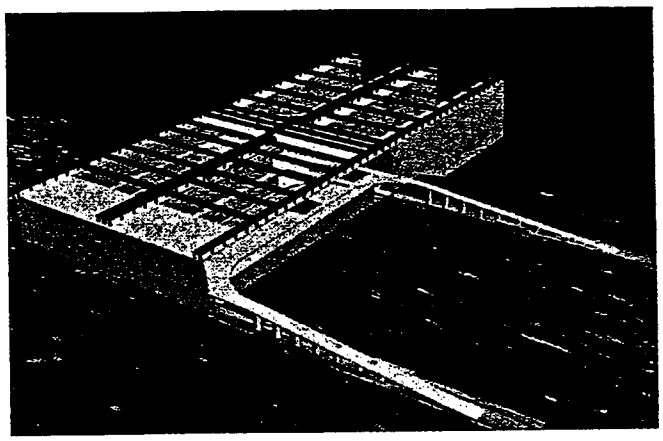
SPEEDPORT™ – The Container Terminal Design for the 21st Century

ACTA Maritime Development Corporation's (ACTA Maritime) patent pending *SPEEDPORT*™ design and operating system meets the needs of today's transportation industry for increased capacity and efficiency in intermodal terminals. The *SPEEDPORT*™ terminal design is a quantum leap beyond present day terminals, yet it does not rely on the development of any new technologies. *SPEEDPORT*™ makes use of existing technology in a simple new configuration to dramatically reduce ship turnaround time and move cargo directly from ships to trains, trucks, and other ships, for "just in time" deliveries.

SPEEDPORT™ uses a fleet of independent vehicles operating on a simple elevated grid of rails and overhead beams above the ship and container yard to make all moves in the terminal. There are no gantry cranes and the numerous buffers associated with a conventional container terminal in ACTA Maritime's *SPEEDPORT*™. Instead, automated spiders efficiently move cargo within the terminal. Productivity is multiplied and operating costs are dramatically reduced as the precision of industrial robotics is applied to the intermodal container transfer process.



At right is an overhead view of the terminal, with the roof removed, showing the beam rail network (dark grey) atop the terminal structure. In the foreground is the ship berthing area, shown here with two berths. Spiders operate on the top of the quay wall and on the athwartship overhead beams. On the left side of the terminal are the grade level rail accesses and truck entrance/exit ramps.



At left is an overhead view of the terminal from the land side, showing the storage/transfer area in the foreground. As in the previous view, the truck and rail accesses to the terminal are also shown. Railcars enter and exit at grade level, while trucks use ramps to access the mezzanine, eliminating dangerous intersections.

SPEEDPORT™ Design Benefits

The benefits of the *SPEEDPORT*™ concept can be broken down into four essential elements:

SPEED: The use of multiple automated "spider" vehicles increases the number of lifts and provides direct transport to next mode of transportation or interim storage. Containers move faster toward their destinations and ships decrease their downtime in port.

SAFETY: Segregated avenues of transport for spiders, on-dock rail, on-dock truck, and personnel make the patent-pending *SPEEDPORT*™ design inherently more safe than conventional terminals.

SECURITY: Use of a high-density storage area with limited access provides maximum protection for valuable cargo in the yard.

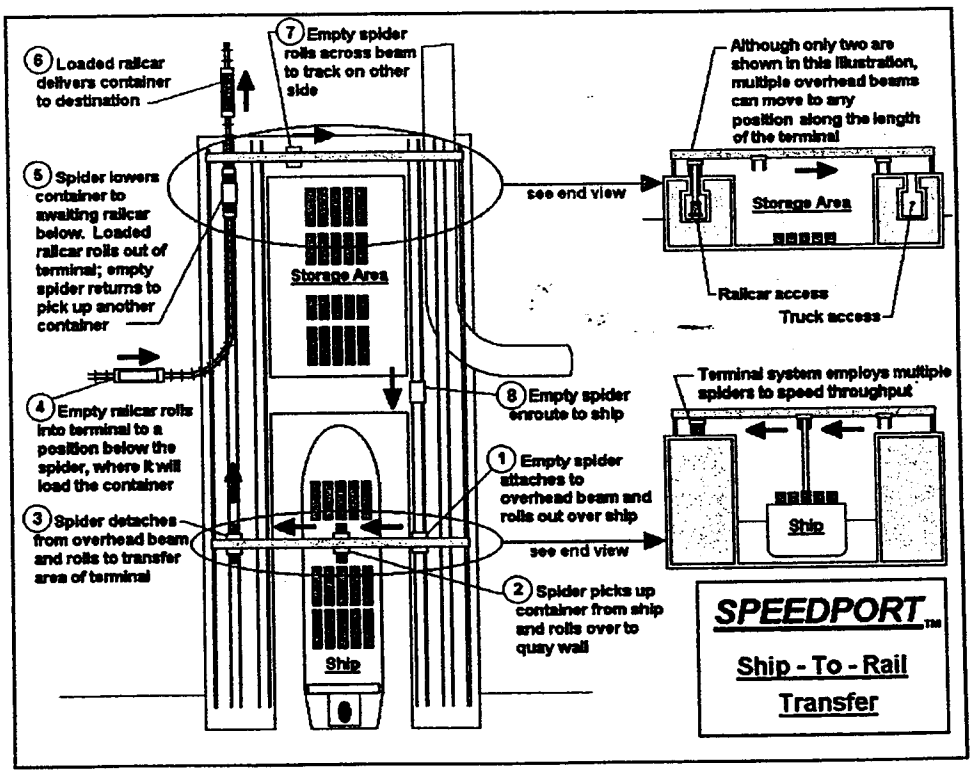
COST: All of the above mentioned benefits are attained at a lower cost than moving the same container through a conventional terminal of similar capacity.

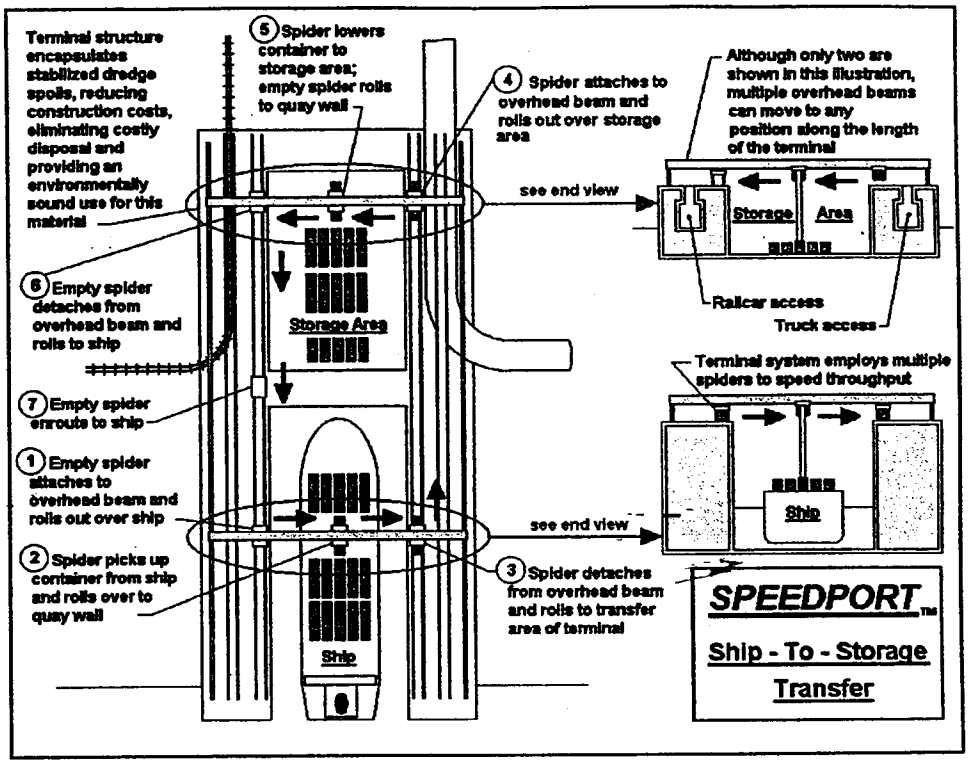
Terminal arrangement yields high transfer rates

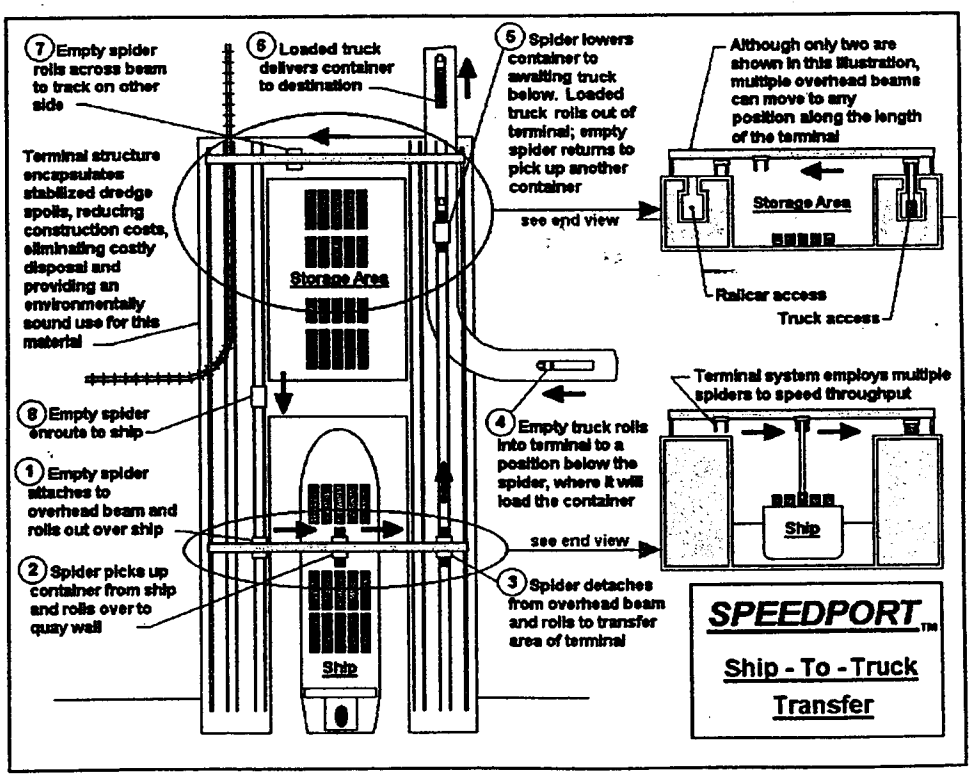
At the heart of the *SPEEDPORT*™ system is a fleet of independent vehicles, called spiders. The spiders operate on an elevated grid of rails and beams to move containerized cargo directly between ships, trucks, railcars and storage. There are no gantry cranes, buffers, straddle carriers, in-yard chassis, and associated multiple-vehicle transfers found in conventional container terminals. The spiders provide a single means of carriage for each container moved within the terminal. A single spider vehicle can pick up, transport and discharge a 20, 40 or 45 foot container anywhere in the terminal under the guidance of a centralized control system. Productivity is multiplied and operating costs are dramatically reduced as the precision of industrial robotics is applied to the intermodal container handling process.

A central computer and IT network control the movements of all spiders. Each spider is capable of lifting and lowering containers independently as directed by the central computer. Traffic is directed in a manner that minimizes congestion. The load plan of each ship is known well in advance of a ship's arrival. Containers are pre-stowed in the interim storage area in the proper sequence for rapid loading. Trim and stability data and bunkering information are considered by the computer when determining the discharge and load-out sequence. *SPEEDPORT's*™ powerful central computer also takes into consideration just-in-time shipments arriving at the terminal. Late arrivals are accommodated as the computer modifies the load plan to ensure safe stowage onboard the ship.

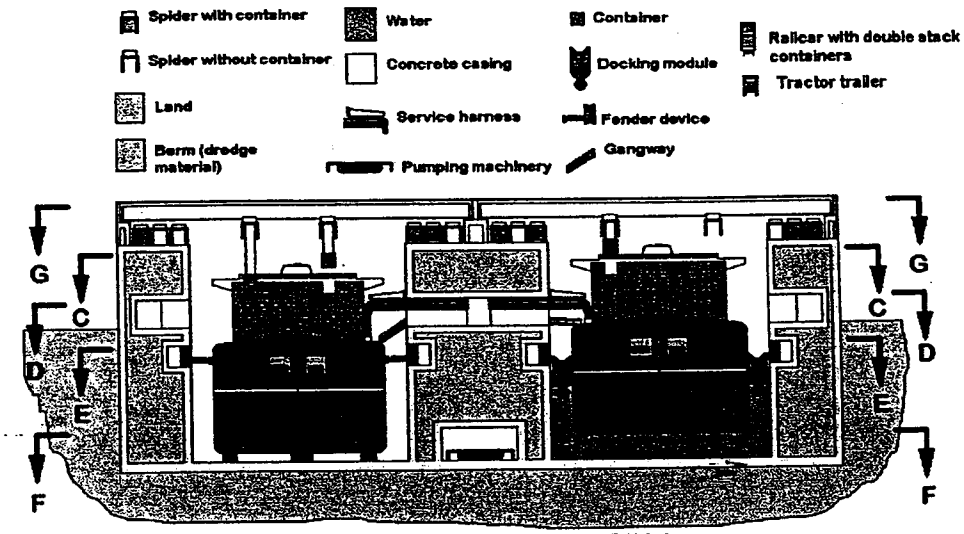
There are four basic types of transfers that can take place within the *SPEEDPORT*™ terminal, namely, ship-to-ship, ship-to-rail, ship-to-truck and ship-to-storage. The following illustrations explain how these moves occur within the terminal, showing the movement of the spider as it picks up a container from a ship and delivers it to its destination. The loading of containers from storage, railcar, truck or another ship occurs in reverse from the illustrations shown here. As these illustrations depict a single-berth *SPEEDPORT*™ terminal, a ship-to-ship transfer is not shown. Terminals with multiple ship berths make use of overhead inter-quay transfer beams, which run the entire width of the terminal, enabling each spider to travel between berthing areas. Other illustrations in this paper show a two-berth terminal. The inter-quay transfer beams are evident in those illustrations.



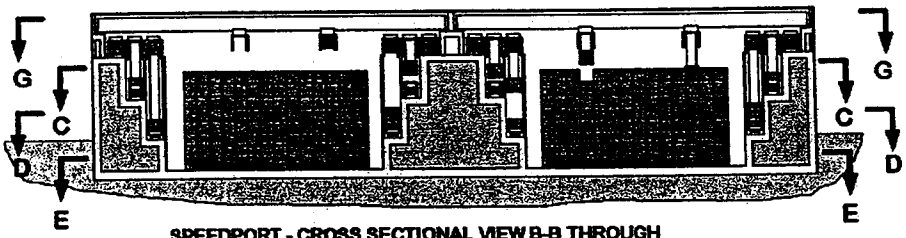

Terminal structure encapsulates stabilized dredge spoils, reducing construction costs, eliminating costly disposal and providing an environmentally sound use for this material
5 Spider lowers container to storage area; empty spider rolls to quay wall
4 Spider attaches to overhead beam and rolls out over storage area
Although only two are shown in this illustration, multiple overhead beams can move to any position along the length of the terminal
see end view
Storage Area
Railcar access
Truck access
6 Empty spider detaches from overhead beam and rolls to ship
Storage Area
Terminal system employs multiple spiders to speed throughput
7 Empty spider enroute to ship
1 Empty spider attaches to overhead beam and rolls out over ship
Ship
see end view
2 Spider picks up container from ship and rolls over to quay wall
3 Spider detaches from overhead beam and rolls to transfer area of terminal
Ship
SPEEDPORT™
Ship - To - Storage Transfer


7 Empty spider rolls across beam to track on other side
6 Loaded truck delivers container to destination
5 Spider lowers container to awaiting truck below. Loaded truck rolls out of terminal; empty spider returns to pick up another container
Although only two are shown in this illustration, multiple overhead beams can move to any position along the length of the terminal
Terminal structure encapsulates stabilized dredge spoils, reducing construction costs, eliminating costly disposal and providing an environmentally sound use for this material
see end view
Storage Area
Storage Area
Railcar access
Truck access
Terminal system employs multiple spiders to speed throughput
8 Empty spider enroute to ship
4 Empty truck rolls into terminal to a position below the spider, where it will load the container
1 Empty spider attaches to overhead beam and rolls out over ship
Ship
see end view
2 Spider picks up container from ship and rolls over to quay wall
3 Spider detaches from overhead beam and rolls to transfer area of terminal
Ship
SPEEDPORT™
Ship - To - Truck Transfer

Below, detailed section views of the berth and transfer/storage areas provide a clearer view of the spiders' access to the ship, storage, and next modes of transport.

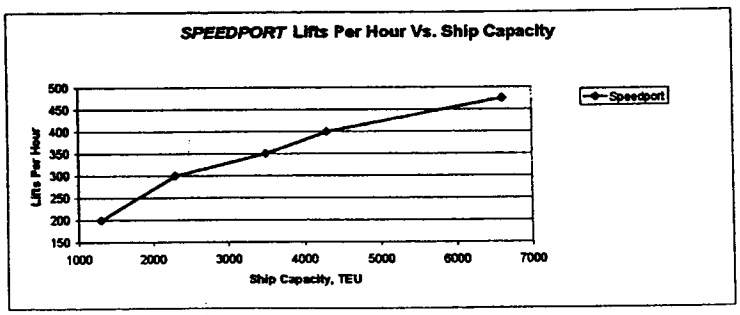


SPEEDPORT - CROSS SECTIONAL VIEW A-A THROUGH DOCK AREA

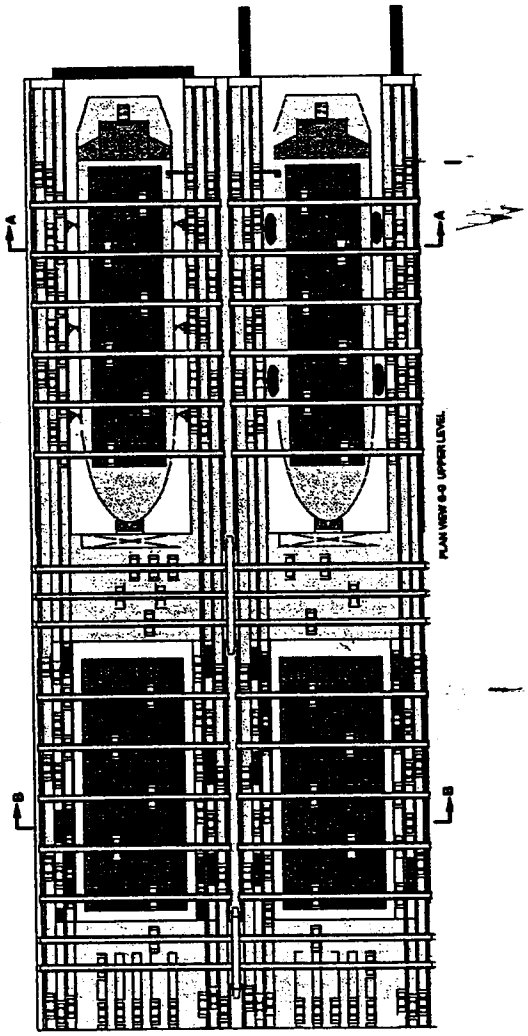


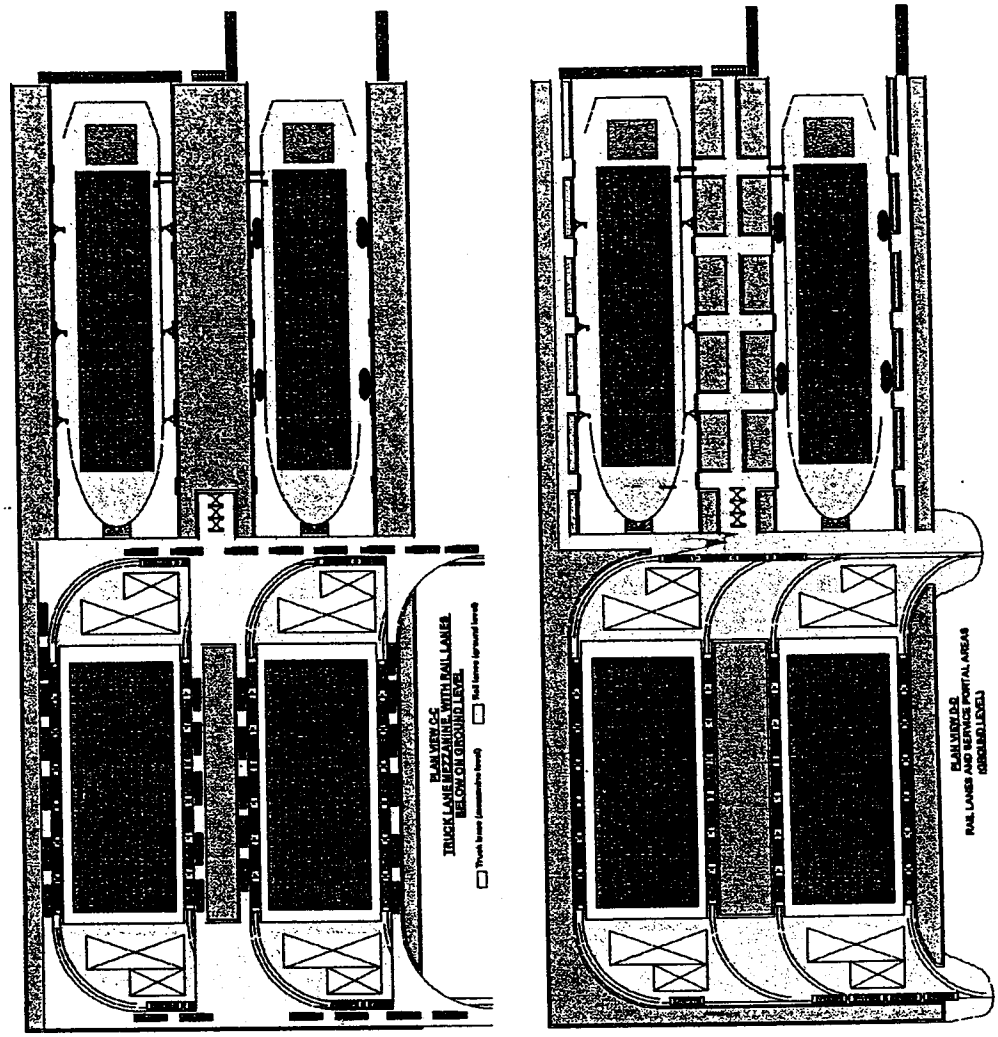
SPEEDPORT - CROSS SECTIONAL VIEW B-B THROUGH STORAGE PIT AND TRANSFER AREA

The availability of numerous spiders, and their self-contained hoists and spreaders, enables all of a ship's container cells to be accessed at the same time. The speed of cargo transfer is dependent on the size of the ship and the number of spiders moving containers to and from the transfer and storage area.



Three plan views of the main working levels of the terminal are provided to further clarify the movement of cargo. The transfer of containers between different areas of *SPEEDPORT*$_{TM}$ is accomplished on the upper level of the terminal.





Safety Inherent in Terminal Design

As detailed in the representative plan views above, all modes of container transport are segregated on different levels within the terminal. The problem of on-dock rail is solved with mezzanine-level truck transfer lanes aligned directly under the spiders' rails of the upper level. Grade level rail lines with clearances for double-stacked cars are similarly routed directly beneath different spider rails on the upper level. There are no disruptions of container flow due to intersecting rail and truck paths in *SPEEDPORT*$_{TM}$. Also, personnel movement to and from the ships is completely separate from the areas where containers are moved. Parts, supplies and stores are all transferred safely to and from the ship without having to negotiate a passage through a busy conventional container yard.

High Density Storage Area Reduces Risk of Loss

SPEEDPORT's™ high-density storage areas are located forward of the ships' berths. The compact stack area is provided with minimal personnel access from the ground. The end to end storage arrangement further mitigates the risk of pilferage in *SPEEDPORT*™. Security can be provided at minimal cost with remote video monitoring and inexpensive motion detectors at the ground level. Terminal insurance expenses will be dramatically lower in *SPEEDPORT*™ than in any conventional terminal.

Optional Features Attract Carriers

The configuration of *SPEEDPORT*™ lends itself to a number of options that will further improve ship turnaround time.

Graving Dock Feature – If desired by the customer, the terminal design allows for any of the slips to be configured as a graving dock. The dock has the capability of being flooded above the normal sea level to speed cargo operations. To minimize the vertical movement of the containers, the water level in the graving dock can be raised to expedite loading and unloading. The central computer system controls the water level in the dock based on the load plan for the ship.
The graving dock configuration also enables a ship to be repaired during cargo operations. Normally a large ship would have to be diverted off its trade route for underwater repairs or regulatory body inspections. The net time saved results in significant cost savings to the carrier.

In areas of the world where tidal fluctuations are extreme, the graving dock option enables affected ports to compete for container traffic.

Rapid Bunkering System – Each of the *SPEEDPORT*™ quays may be constructed to contain large fuel tanks. Bunkering of the ship can be accomplished concurrent with container loading and discharge. Fueling is controlled by the central computer system. Vacuum pumps connected to the ship's fuel tank vents stabilize the pressure within the tank being filled, enabling rapid transfer of fuel to the ship. The terminal's fuel storage tanks are filled from pipeline, conventional barges, and ships at their normal rates. The enclosed slip configuration mitigates the risk of environmental contamination in the event of a spill while fueling.

Safe Constructive Use of Dredge Materials from Local Waterways – The entire quay and most elevated shoreside structures may be constructed using encapsulated dredge material removed from nearby waterways. This greatly reduces the cost of deepening the channel leading to the *SPEEDPORT*™ terminal.

Transfer Speeds Quantified

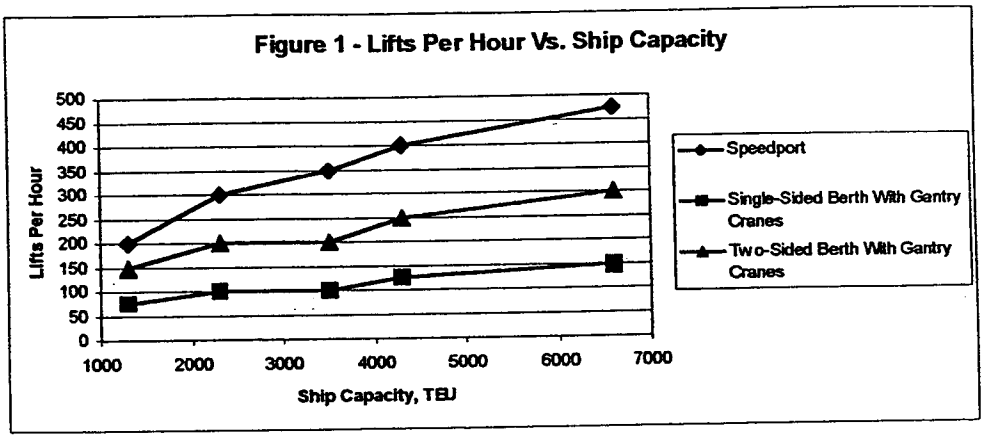
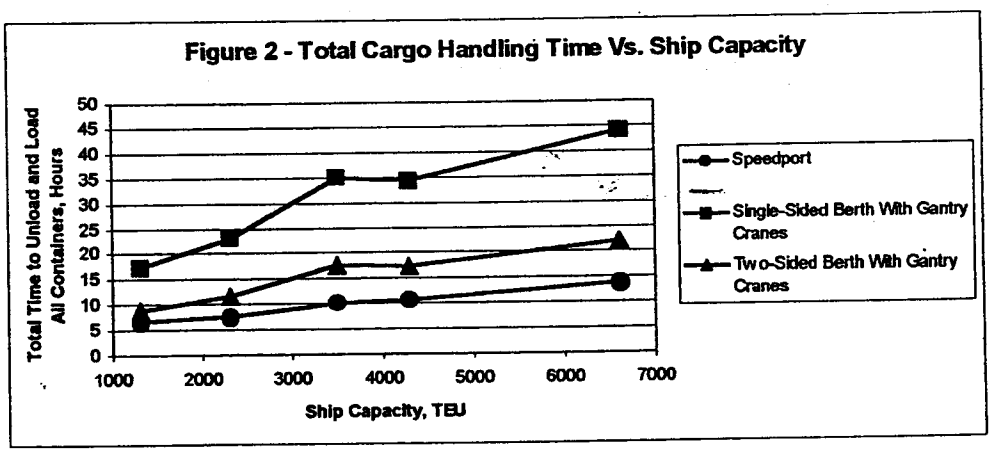


Figure 1 represents the relationship between moves per hour and ship capacity for a *SPEEDPORT*$_{TM}$ berth, a "ship-in-a-slip" (container cranes on each side of a slip), and a conventional single-side container terminal berth. At a single or double-sided conventional terminal berth, the increase in moves per hour with increasing ship capacity (size) is attributable to having more cranes alongside the vessel. However, only a limited number of cranes can be positioned alongside a vessel of given size. *SPEEDPORT*$_{TM}$, on the other hand, is capable of placing one overhead beam over every row of ship's containers. The ability to access more of the ship's containers simultaneously translates into greater transfer speeds.

Reduced Time in Port Leads to Greater Productivity for Carriers



Similar to Figure 1, Figure 2 demonstrates the decided advantage of a *SPEEDPORT*$_{TM}$ over a conventional terminal, as the total amount of time required to unload and load containers is significantly less. Again, *SPEEDPORT's* $_{TM}$ capacity is attributable to its ability to simultaneously work every row of containers on the ship. Conventional gantry cranes, however, are limited in how close they can be positioned next to one another, thereby limiting

the number of rows that can be worked simultaneously.

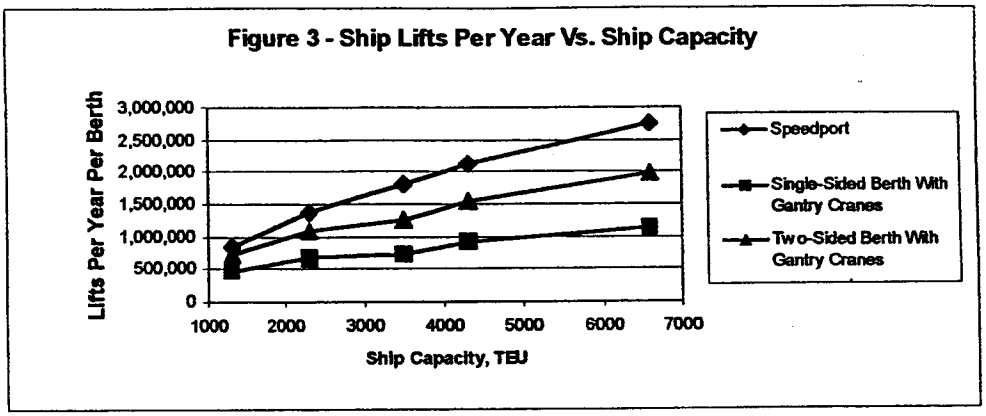
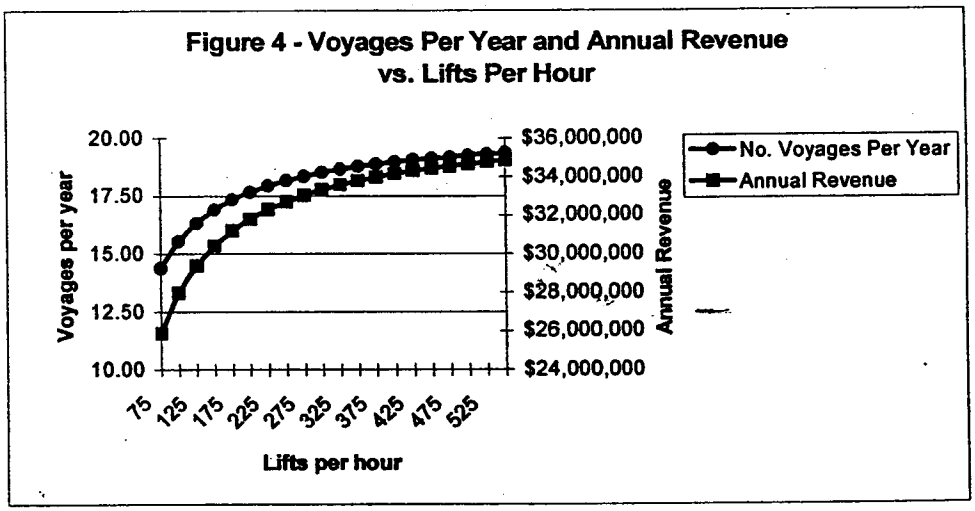


Figure 3 further accentuates the advantages gained through *SPEEDPORT's*™ ability to work every row of ship's containers simultaneously. Containers are transferred to and from the ship by robotic spiders that move each container from point to point within the terminal. The speed and economy of the spiders cannot be matched by a conventional terminal's cranes, chassis, RTG's and straddle carriers.

SPEEDPORT™ Means Greater Productivity for Carriers



Figures 4 and 5 depict how increases in terminal productivity, such as those achievable through *SPEEDPORT*™, can benefit carriers. Figure 4 plots the number of ship voyages per year and annual container revenues versus moves per hour. For the example shown, a comparison was made using a 6000 TEU ship making a 4000 nautical mile round trip voyage, laden with 300 20-foot and 2850 40-foot boxes, with 3.5 hours of maneuvering time on either end of the voyage. Revenue for sea transport was assumed to be $300 US per TEU each way. Even in the most efficient configuration, a conventional yard is not capable

of moving cargo at the productivity rates characteristic of *SPEEDPORT*$_{TM}$. It is readily apparent that *SPEEDPORT*$_{TM}$ gives carriers an advantage of increasing the number of voyages possible in a given year, and thus an increase in revenues earned.

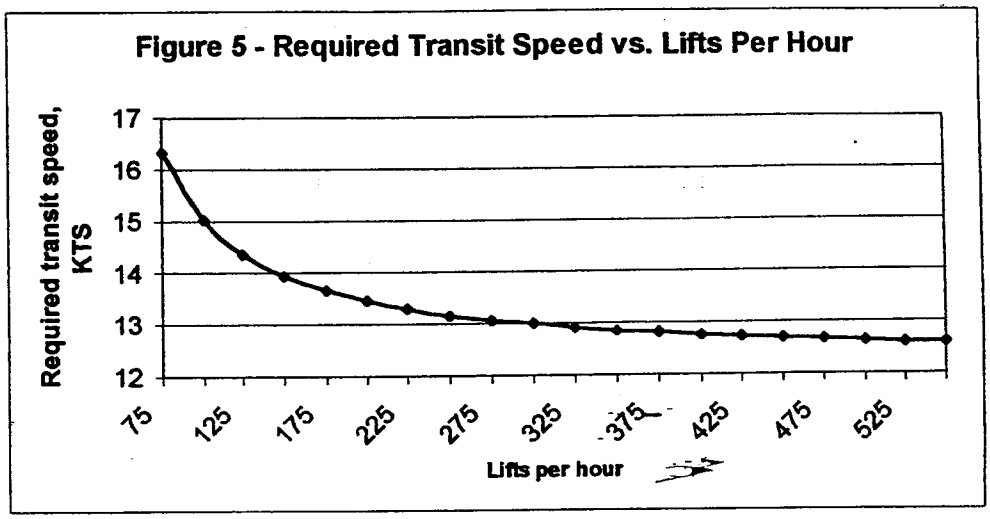


Figure 5 looks at carrier savings from a different perspective. For a 6000 TEU ship on a 4000 nautical mile transit, with a fixed voyage duration of 28 days, transit speed requirements decrease as terminal cargo transfer speeds increase. For the carrier, this means that ships can operate at more economical speeds during transit, resulting in significant savings. Also, slower transit speed requirements make the charter of slower ships, which generally command lower per diem rates, viable for certain trades where they would not otherwise be considered.

Compact Terminal Provides Quantum Leap in Productivity Per Acre

FIGURE 6 - TERMINAL LAYOUT COMPARISON

Attribute:	*Speedport Terminal*	*Single-Side Berths With Gantry Cranes*	*Two-Sided Berths With Gantry Cranes*
No. of Berths (6600 TEU-sized ships)	2	2	2
Capacity, Ship Lifts Per Year	5,534,025	2,267,294	3,987,310
Yard Storage Capacity, TEU	26,400	26,400	26,400
Water Frontage, Feet	560	2,200	1,160
Number of Gantry Cranes	--	10	20
Number of Spiders	139	--	--
Number of Straddle Carriers	--	35	126
Number of Rubber Tire Gantries	--	13	--
Storage Stacking, No. Containers High	9	4	4
Required Storage Area, Acres	14	143	143
Total Terminal Area, Acres	45	165	200
Ratio of Storage Area to Total Area	0.31	0.87	0.72

Figure 6 compares the physical attributes of *SPEEDPORT*$_{TM}$ to conventional terminals of an equal number of berths and storage capacity. The comparison shows that the *SPEEDPORT*$_{TM}$ terminal configuration requires significantly less land and waterfront. Thus *SPEEDPORT*$_{TM}$ results in dramatically lower land acquisition costs. Note the higher storage-to-total area ratio for the conventional terminals. Most conventional terminals require a higher percentage of storage to total area due to the absence of high-density stacking. *SPEEDPORT's*$_{TM}$ high-density storage makes use of high stacking and overhead-only access, eliminating the need for wide aisles for side access to container stacks, straddle carriers, and in-yard chassis.

Cost Considerations

ACTA Maritime Development Corporation is currently engaged in the development of cost comparison studies for a number of *SPEEDPORT*$_{TM}$ facilities. Physical construction costs involve a myriad of variables from site to site. Detailed comparisons can only be done on a case-by-case basis, taking into consideration the requirements of the customer for size, throughput, berth areas, and storage and transfer area configurations. The cost of new post-panamax cranes is now reaching over $10 million US. Even when using the novel "ship-in-a-slip" arrangement, each berth would require at least nine cranes, and fleet of support vehicles and their operators to compete with an automated *SPEEDPORT*$_{TM}$. With spiders estimated at $500,000 each, the cost of a competitive fleet of vehicles is only $40 million per slip.

Community Concerns

When compared to conventional terminals with large gantry cranes, *SPEEDPORT*$_{TM}$ is less intrusive aesthetically, as it is an enclosed covered structure. When a *SPEEDPORT*$_{TM}$ is built nearby, residential properties may be located near to the waterfront. Unlike conventional container port areas, the local horizon will not be disrupted by a clutter of huge cranes, with their booms lifted high above the landscape.

SPEEDPORT$_{TM}$ will be more readily accepted by the local community than a conventional port facility, as it is more environmentally sound. The community's fear of possible contamination in the event of an oil spill while fueling can be allayed as the *SPEEDPORT*$_{TM}$ berth configuration protects the local waterway.

Also, air pollution is reduced in the harbor area as *SPEEDPORT's*$_{TM}$ on-dock rail capability unlocks the potential for greater intermodal rail service, reducing the number of trucks on the local roads and highways.

Inland Applications

Ports on inland waterways can also employ *SPEEDPORT*$_{TM}$ terminals with the same advantages as deep-water ports. A modified *SPEEDPORT*$_{TM}$ design and operating system can also be applied to truck-to-rail intermodal hubs.

Military Variant Provides Deployable Port

A transportable variant of the *SPEEDPORT*$_{TM}$ design and operating system may be of considerable value to the U.S. Armed Forces. Transported aboard a FastShip, a small scale deployable *SPEEDPORT*$_{TM}$ could be rapidly constructed adjacent to any beach or shoreline. Once erected, a fully operational, efficient container terminal would be ready to accept containerized support materials and supplies for deployed troops.

SPEEDPORT$_{TM}$ Development Status

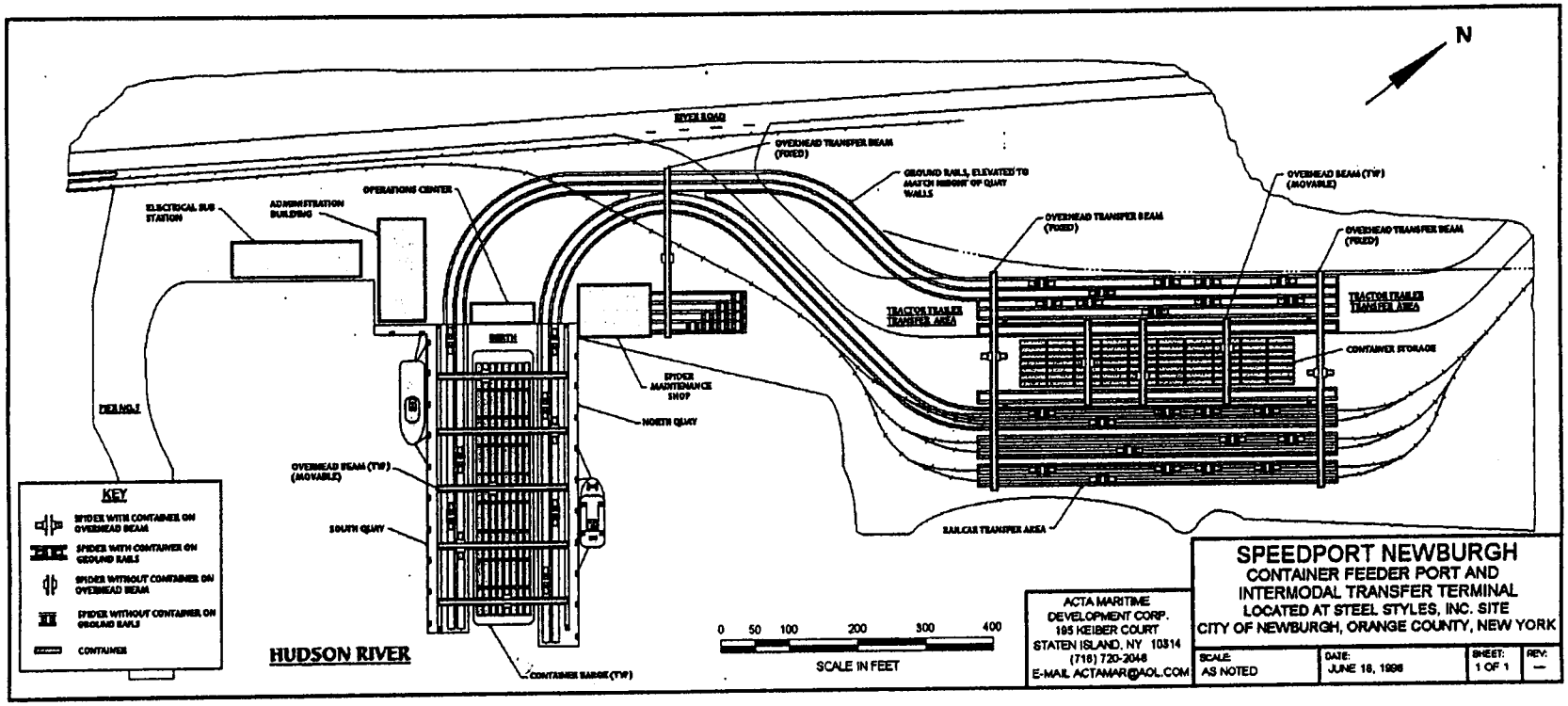
ACTA Maritime Development Corporation is in the process of developing strategic partnership relationships with firms that are interested in developing and manufacturing the components of *SPEEDPORT*$_{TM}$. The firm is also in the process of developing detailed cost estimates for a number of facilities of different sizes.

Conclusion

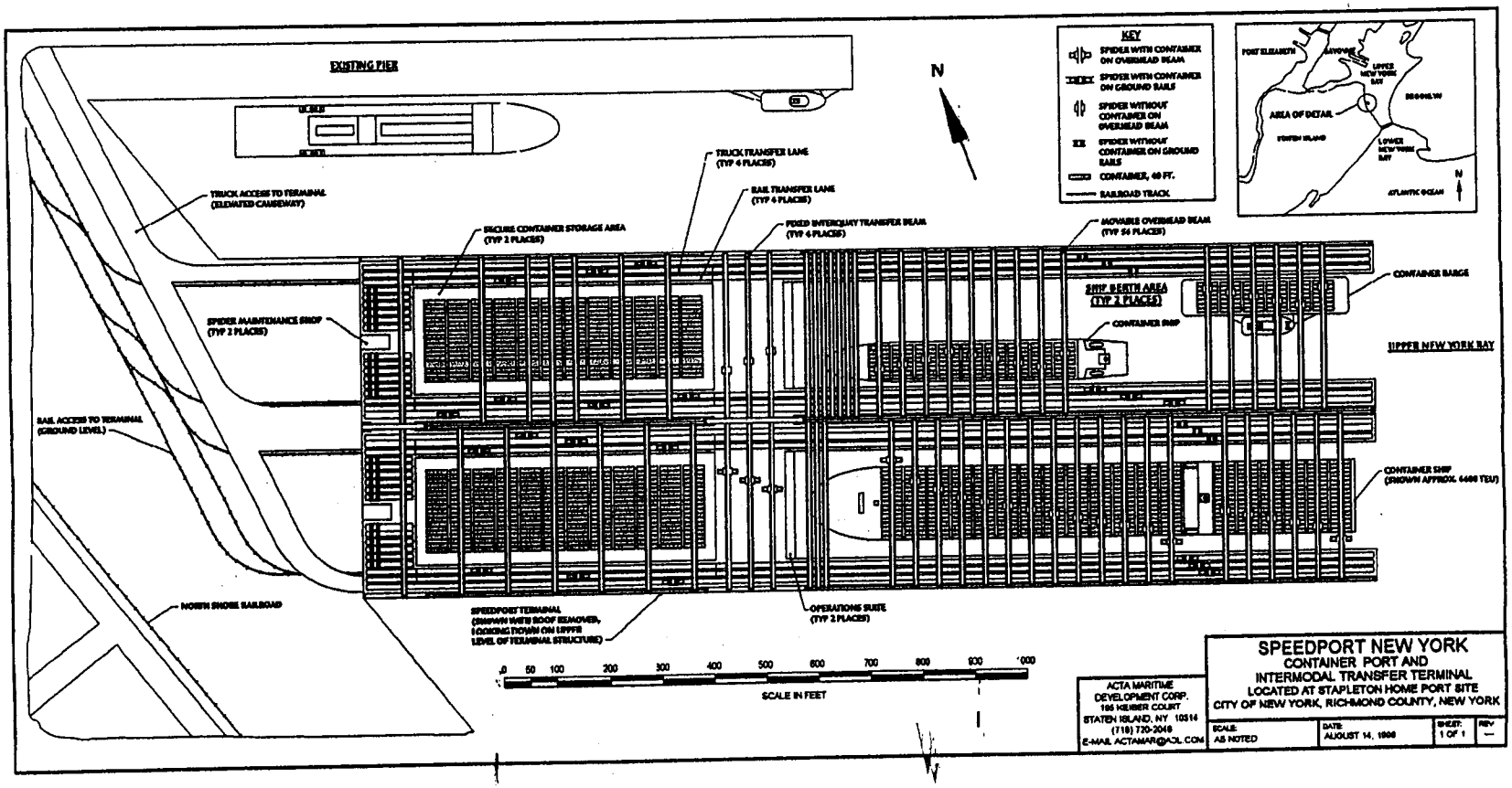
The future of containerized cargo transportation depends on the adoption of new methodologies and techniques for loading and unloading the ships of the future. *SPEEDPORT*$_{TM}$ represents a quantum leap forward in container handling. By employing existing technology in a whole new process for the intermodal transfer of containers, *SPEEDPORT*$_{TM}$ enables new economies of scale that will change world trade as we know it. Certainly, *SPEEDPORT*$_{TM}$ will set the new standard for intermodal container terminal design for the 21st Century.

Representative Sites (attached)

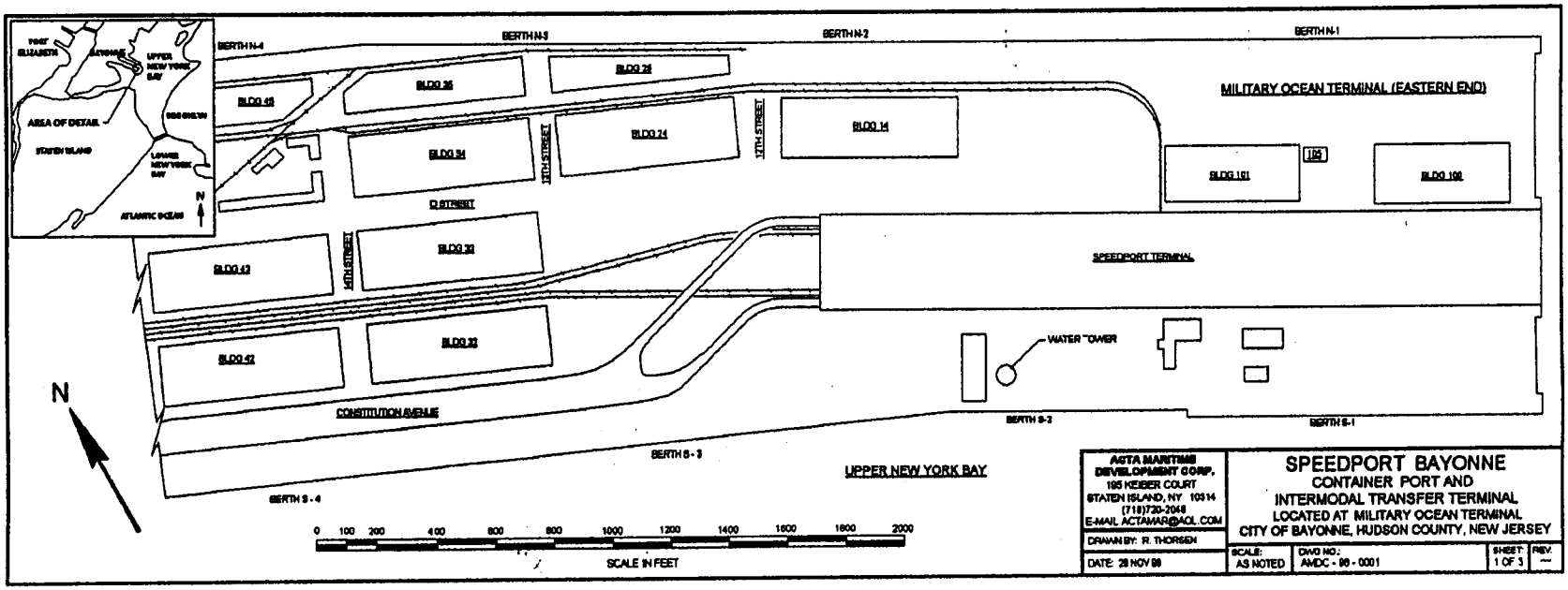
Newburgh, New York (1 sheet)
Stapleton, Staten Island, New York (1 sheet)
Military Ocean Terminal, Bayonne, New Jersey (3 sheets)



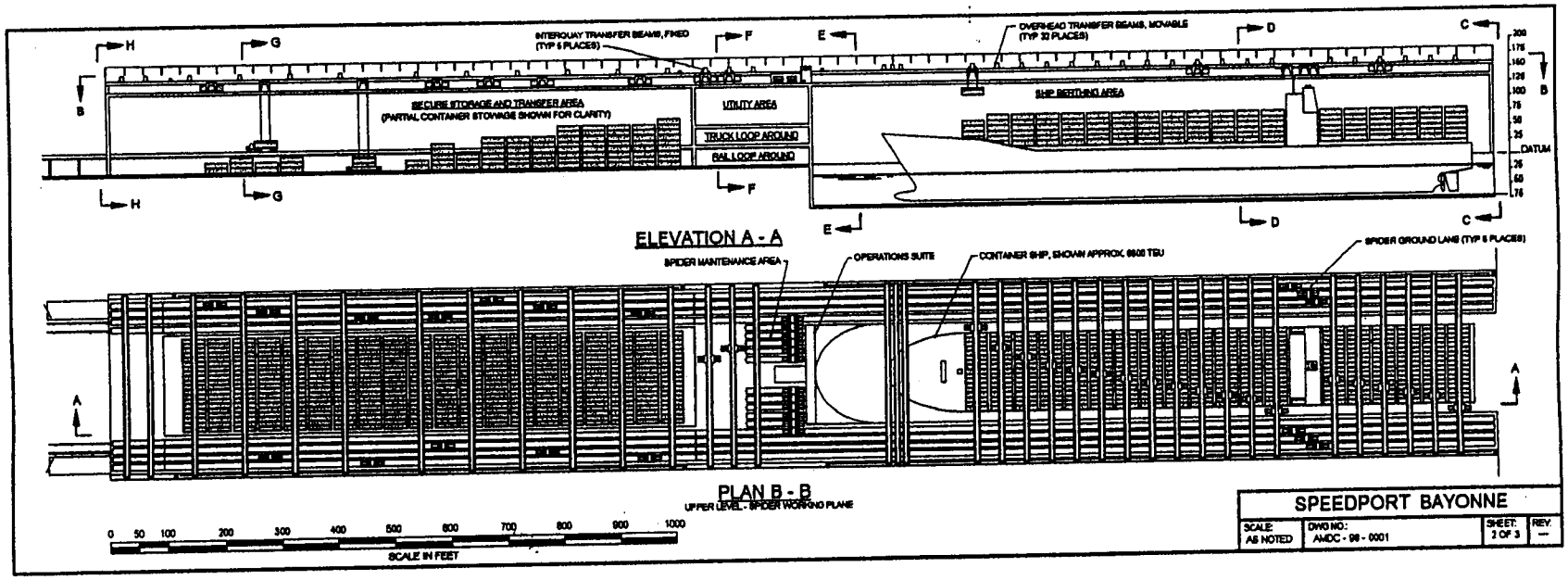
Newburgh, New York – Newburgh is a small city on the western bank of the Hudson River, north of New York City. A potential development of a small port, servicing barges and small ships, is envisioned at the site of an under-utilized shipyard. This site plan demonstrates the adaptability of the *SPEEDPORT*$_{TM}$ design to the geography of almost any site. A facility that has seven overhead beams above the berth is capable of moving over 100 containers per hour.

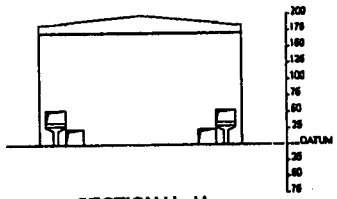


Stapleton, Staten Island, New York – The eastern shore of the borough of Staten Island has direct access to the shipping channels and is provided with an enormous turning basin for the largest ships of tomorrow. The Staten Island site plan shows a large *SPEEDPORT*$_{TM}$ facility servicing a 6,600 TEU container ship in one berth while the second berth is occupied by a tug, a barge, and a feeder ship. Staten Island's eastern shore could be fed by a freight-only truck viaduct and rail line built on the right-of-way of the inactive North Shore Railroad. Rail cars would be marshalled at an existing yard adjacent to the Howland Hook Marine Terminal.

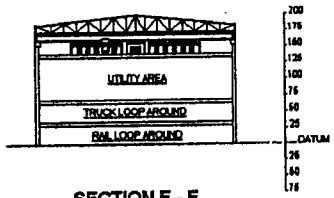


Military Ocean Terminal, Bayonne, New Jersey – Due to be turned over to the Local Base Re-Use Authority at the end of 1999, this property is shown with a single berth *SPEEDPORT*$_{TM}$ built around the existing graving dock. Again, the ship depicted is a 6,600 TEU vessel. The modular nature of the *SPEEDPORT*$_{TM}$ design lends itself to phased construction in response to the throughput requirements of the port. A second and third berth could be built, at later dates, to the north and south of the graving dock.

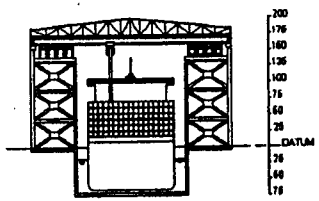

INTERQUAY TRANSFER BEAMS, FIXED
(TYP 6 PLACES)
OVERHEAD TRANSFER BEAMS, MOVABLE
(TYP 32 PLACES)
SECURE STORAGE AND TRANSFER AREA
(PARTIAL CONTAINER STOWAGE SHOWN FOR CLARITY)
UTILITY AREA
TRUCK LOOP AROUND
RAIL LOOP AROUND
SHIP BERTHING AREA
DATUM
ELEVATION A - A
SPIDER MAINTENANCE AREA
OPERATIONS SUITE
CONTAINER SHIP, SHOWN APPROX. 8600 TEU
SPIDER GROUND LANE (TYP 5 PLACES)
PLAN B - B
UPPER LEVEL - SPIDER WORKING PLANE
0 50 100 200 300 400 500 600 700 800 900 1000
SCALE IN FEET
SPEEDPORT BAYONNE
SCALE: AS NOTED
DWG NO.: AMDC - 98 - 0001
SHEET: 2 OF 3
REV. —



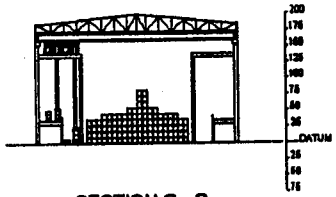
SECTION H - H
TRUCK AND RAILCAR INGRESS/EGRESS



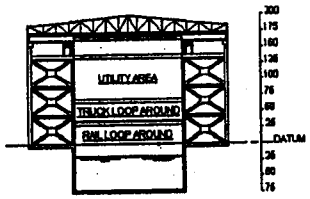
SECTION F - F
INTERQUAY TRANSFER BEAM AND SPIDER MAINTENANCE AREA



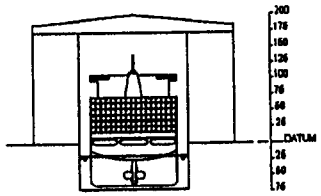
SECTION D - D
SHIP BERTH AREA



SECTION G - G
CONTAINER STORAGE AND TRANSFER AREA



SECTION E - E
SHIP BERTH AND OPERATIONS SUITE



SECTION C - C
SHIP BERTH AREA INGRESS/EGRESS

SPEEDPORT BAYONNE			
SCALE: AS NOTED	DWG NO.: AMDC - 98 - 0001	SHEET: 3 OF 3	REV: —

ACTA Maritime Development Corporation
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E-mail actamar@aol.com

February 7, 2002

Mr. James Blackburn, Chairman
Galveston Bay Conservation and Preservation Association
2600 NASA Road 1, Suite 103
P. O. Box 323
Seabrook, Texas 77586

Dear Mr. Blackburn:

Thank you for your interest in ACTA Maritime's *SPEEDPORT*$_{TM}$ as a better alternative to conventional marine container terminal designs for the Ports of Houston and Galveston. *SPEEDPORT*$_{TM}$ is a highly space efficient, environmentally acceptable, intermodal transfer terminal that will meet the needs of the transportation industry and the concerns of the community.

In the applications you have envisioned at Spilmans Island or Shoal Point, a *SPEEDPORT*$_{TM}$ will be capable of delivering the required throughput on a much smaller footprint than a conventional terminal of similar capacity. In a *SPEEDPORT*$_{TM}$ terminal, the number of container transfers are minimized and true just-in-time transfers between modes of transportation are possible. With proper traffic control and scheduling, a container can be moved directly from the inbound ship onto an outbound barge, railcar or truck chassis, without ever landing on the ground. The increased speed of cargo transfer makes much greater asset utilization possible, accelerating the rate at which the capital investment in the terminal can be recovered.

As our patented *SPEEDPORT*$_{TM}$ design is modular in nature, incremental expansion is possible. Additional slips and transfer/storage areas can be added to increase capacity without impacting the ability to move cargo through the port. Also, the enclosed compact *SPEEDPORT*$_{TM}$ terminal is much less intrusive to the local community and ecosystems.

Presently, conventional container terminals are wrestling with the challenge of increasing productivity by retrofitting traditional cranes and vehicles with automated features. ACTA Maritime's *SPEEDPORT*$_{TM}$ system and design is configured to take full advantage of the highest possible automation. While *SPEEDPORT*$_{TM}$ has yet to be built, the development process will be short, as reliable existing materials handling equipment and logistics management technology can be readily applied to the patented system and design.

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ACTA Maritime recently submitted a development project application to the federally funded Center for Commercial Development of Transportation Technologies (CCDoTT) at California State University – Long Beach. This project will serve to validate the *SPEEDPORT*$_{TM}$ concept in various sizes and locations in the U.S. If this of interest to you, we would be pleased to work with your group and the appropriate local authorities to include the Port of Houston/Galveston as one of the sites to be studied.

Again, thank you for your interest in *SPEEDPORT*$_{TM}$. I look forward to hearing more about the plans for expansion of your region's port facilities. Please let me know if you require any additional information regarding *SPEEDPORT*$_{TM}$ or if I can be of assistance to you in any other matter.

Sincerely,

John O. Amtzen
President

Section 4
Trends in Gate and Terminal Design

TRANSYSTEMS CORPORATION

4.0 TRENDS IN GATE AND TERMINAL DESIGN

The factor that has been the biggest contributor historically to positively influencing cargo handling in a marine terminal has been the relatively recent containerization of cargo. Cargo can be moved easier and quicker than before. Yet, today, information technologies are quickly proving themselves to be an even greater factor relative to cargo handling and terminal design, specifically noting gate design.

Gate design is a terminal factor that helps cargo to enter a facility or terminal. Gate design permits the speed and method by which access is given to a terminal for the delivery of cargo. Difficulties in accessing the terminal can result in delays for cargo getting inside the terminal, scheduled vessel departure time, and scheduled cargo pickup time (for the same truck delivering the cargo). These difficulties are today and in the near future to be minimized by leading technologies that are reducing gate-processing time yet also assisting sto track cargo better.

Land utilization at Port Everglades could be more efficient for the number of containers that are handled by each tenant annually as well as for the amount of time that each berth is utilized for the loading or off-loading of containers. More efficient methods of handling containers could create incentive for tenants to handle higher volumes of containers. Modern technologies known as "Intelligent Transportation Systems" can track each unit of cargo; a container or unit's time for storage or movement throughout the Port or terminal can be tracked. Each container has a code on its side that can be read as it enters the port via a vessel, truck or rail car. Equipment such as automated scanners or cameras manned by personnel can track a container as it enters a port, moves throughout the port, and leaves the port. The position and time of a container can be automatically or manually entered into a database or log. The result is that a container's storage or movement time can be computed or noted.

4.1 GATE DESIGN

Gate design is evolving; therefore, contemporary and emerging gate design planning typically will considers the following factors:

- Terminal footprint – size of the gate Facility
- Flexibility – Expansion Capabilities
- Standardization of cargo,
- New technologies
- Proximity to roadway – inside and outside the terminal.

These factors help to determine gate layout. Many of these factors are interrelated.

4.1.1 Total Footprint – Size of the Gate Facility

The size of the gate facility should consider:

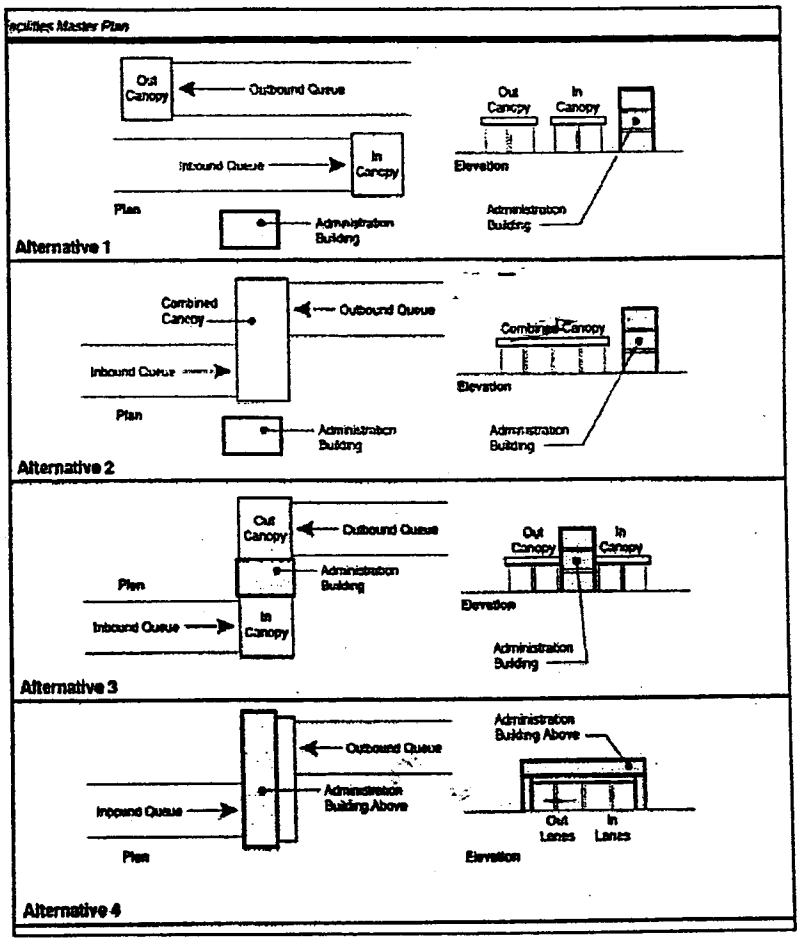
- The necessary number of lanes – either sharing (reversible) or separation of inbound and outbound lanes;
- Additional trucking services such as:
  - Scales
  - Maintenance lane(s)

- Immediate inspection area for United States (US) Customs, truck repair, and general port security; and
- Queue space.

At one time, trucks entered and left a terminal utilizing the same travel lane(s). Yet today, with better scheduling of vessels, terminal operators can designate gate lanes for inbound traffic during certain periods of time and outbound for others. Also, the simple separation of travel lanes has improved gate processing.

Yet also, a gate should be able to accommodate truck inspection, mainten-ance, and queuing. The same concept applies to simply having enough lanes for truck/cargo proc-essing. The number of lanes simply applies to anticipated truck volume. The expected number of trucks influences the plan-ned number of lanes at the gate. In some cases, lanes can be considered bi-directional dependent upon time of day. For example, a vessel is primarily handling imports. Therefore, the gate will predominantly handle trucks leaving the terminal with boxes yet trucks entering the terminal with either empty boxes, no chassis, or an empty chassis.[1] The point here is that travel lanes can be used for both inbound and outbound truck traffic dependent upon the oper-ations of the terminal. See Figure 1.

Figure 4.1: Master Plan Alternatives



Note that scales are also important to gate operations. The weight of the cargo leaving the terminal should be at or below state-specified or federally-specified standards. Having a scale in

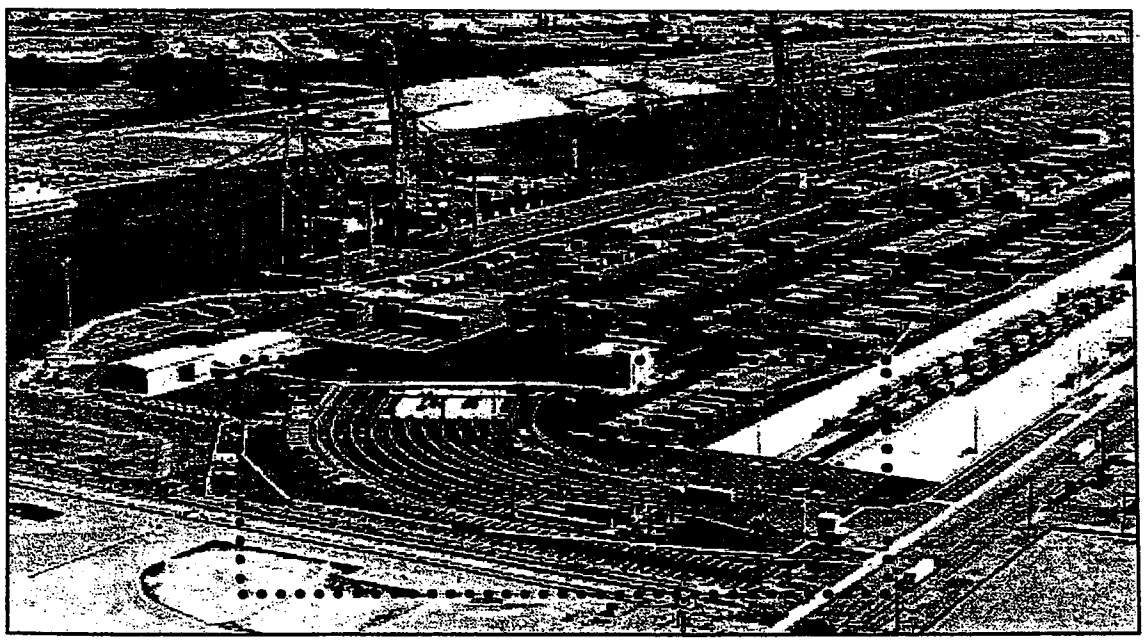
[1] This case applies mostly to containerized cargo. Yet note that other cargoes being imported also need an empty trailer to be transported over-the-road, once off-loaded from the vessel.

the planned size of the terminal is a convenience that has been recently developing and should be considered for safety "over-the-road" and for facilitating the movement of cargo between the terminal and origins / destinations. The Port of New Orleans recently installed two new scales within the Upriver Facilities located on the Mississippi River, along with implementation of the Clarence B. Henry Truckway. The Truckway assists trucks to move out of one primary gate, to access interstate quicker, and get to their destinations with much more ease. As any terminal becomes more efficient, it attracts more cargo, and therefore becomes a destination for more cargo creating more truck traffic and demanding an efficient gate processing system.

A gate facility located next to the primary access roadway and not having a buffer zone between the gate facility and the roadway cannot accommodate trucks entering a terminal "with-load". Trucks can begin to stack up in the roadway. Some terminals do not have sufficient space for the terminal and the buffer zone; trucks begin to park on the road shoulder to queue to enter the terminal. This situation highlights insufficient gate access as well as an unsafe roadway situation.

The same concept applies to inside the terminal in that critical terminal cargo storage or handling space can be utilized for truck queue space which is not necessary and limits cargo storage space (and maybe other factors). The Hyundai Facility in the Port of Tacoma has provided a great amount of space in front of the gate. See Figure 2. Older terminals do not have the same amount of space. Trucks typically queue up near Almonaster Road outside France Road facilities to simply enter the terminal. Industrial Canal facilities in New Orleans were developed in the 1950's and 1960's.

Figure 4.2: Hyundai Terminal in Port of Tacoma

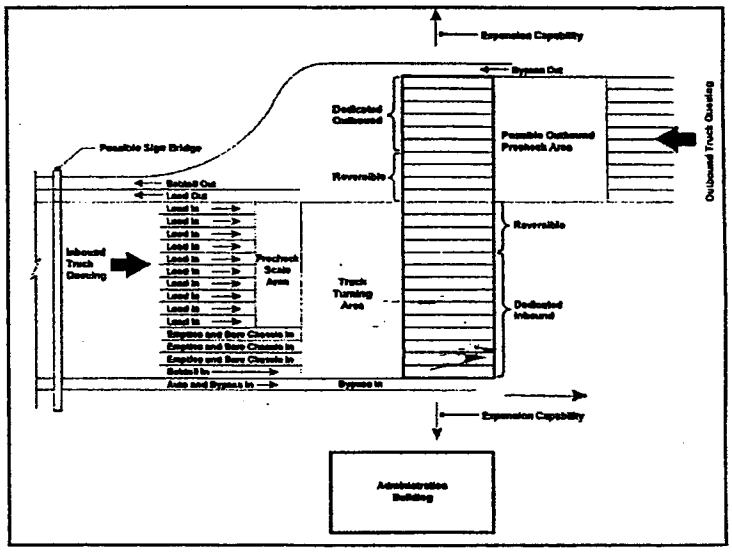


4.1.2 Flexibility - Expandability

The flexibility of the gate relative to the initial design is very important. Older terminals should be redeveloped yet new gate facilities should allow for flexibility or expansion. See Figure 4.3.

Because some existing gate facilities should be redeveloped, it is important to undertake this process as soon as possible. It is important to reduce wait times for trucks as soon as possible. A terminal that was primarily handling either more than one type of cargo or the once-traditional breakbulk (palle-tized) cargo may now be moving containers in port or wholly. (For example, a container terminal also handling Roll-on/Roll-off (RO-RO) cargo.) Therefore, initial design of an existing gate facility or reuse of an old gate facility will take into account handling, in effect, multiple types of cargo, even if not at the same time. For example, including in the design a separate processing lane which is wider and does not have a canopy or a canopy of greater height allows for Roll-on/Roll-off or other neo-bulk cargoes that can be off-loaded by the existing wharf cranes or even vessel cranes.

Figure 4.3



4.1.3 Existing Technologies

The standardization of cargo led to improvement of older manual methods of gate inspection to contemporary methods.

Older methods involved a person manually checking the truck, driver and load. See figure 4.

Video cameras or scanners can today be pointed in a particular direction at all times so that a singular person in a central building can read the bar code on a box. Thereby, the separation of people from trucks improving the accessibility of trucks to the terminal with little or no conflict further improves gate processing.

Figure 4.4

Figure 5: Conventional Gate Technology

The relatively new Hyundai Terminal in the Port of Tacoma utilizes this technology to process trucks quicker and reduce personnel needs. The boxed area within Figure 5 highlights the gate facility at this terminal. Notice that one building contains the personnel to process approximately ten lanes of truck traffic.

4.1.4 New Technologies

Information technology is very important to future gate design. The ability of a gate scanner, in contrast to a person checking the cargo and truck manually or physically, reduces gate time drastically. Note the contrast regarding the Maher Terminal in Port Elizabeth and North Charleston in South Carolina. The ability to move a truck through a terminal is important.

Operations which scan cargo codes attached to the cargo permit the gate to operate virtually personnel-free yet more importantly allow for quicker "gate times". As new technologies are currently and quickly evolving, more complex methods of tracking cargo within a terminal are coming to reality. SPARCS and EXPRESS, each developed by Navis LLC, are two software packages that can assist in tracking cargo within a terminal.[2] These systems, linked to gate operations, allow for quicker gate processing times for trucks accessing or leaving a terminal.

4.1.5 Summary

Gate design is critical. Maher Terminals in Port Elizabeth under the Port Authority of New York/New Jersey processes trucks in approximately one minute per truck. Port Elizabeth demands uniformity of data relative to cargo and truck processing from the different shipping lines. In contrast, the North Charleston Terminal in South Carolina has processing times of approximately five minutes. This difference in truck processing has a direct effect on:

- Truck "on-terminal" time
- Hot-box delivery
- Just-in-time delivery
- Other customer service requirements

4.2 TERMINAL DESIGN – NEW TECHNOLOGIES

Terminal design is similar to gate design yet at a larger scale. Cargo or trucks move through a gate as they move through a terminal. The time which they take to get through the gate or terminal is critical to the overall ability of the terminal to process cargo. Again, information technologies for tracking containers are proving to greatly influence terminal design.

[2] SPARCS is a real-time graphical software that assists in planning / controlling operational functions of a container terminal. EXPRESS is an oracle-based comprehensive database that assists in handling terminal transactions such as bookings. Navis LLC is a "cutting edge" developer of software for container terminals and shipping lines.

This section primarily discusses new technologies regarding terminal planning. The primary historical development, which has affected terminal design to any degree, is containerization. As containerization will continue to grow in the maritime cargo-handling market, automation which relies on information technologies will affect terminal planning and design.

The systems discussed below are new technologies - some for high-density storage and some for the more efficient movement of containers. Yet all of these systems could inherently have container-tracking capabilities.

4.2.1 Automated Terminal Container Handling Systems

The expansion of multimodal transport has led many ports to make capital investment in facilities, considering automated container handling systems. The purpose is to increase the speed and efficiency of handling containers. The value of land near water has risen placing greater demands upon terminal efficiency – deriving greater volumes of cargo handled on ether given space or less space (land). Automated terminal systems include driverless stacking cranes as well as automated guided vehicles, which are basically driverless powered trailers that transfer containers from stacking or storage to quayside.[3]

In the late 1970's, Matson Terminals proposed an automated rail-mounted [large gauge (180-200 feet)] alliance bridge crane concept for their marine terminals within the Ports of Richmond and Los Angeles. The alliance bridge cranes are still in use today yet the automated system could not meet the retrieval accuracy of two inches (repeatable).

There are several automated container or terminal system concepts that currently exist or are actually being used to some degree today. Some of these concepts include:

- Robotic Handling Systems,
- Computainer,
- Bridge Crane on Concrete Supports, and
- Bridge Crane on Concrete Supports for Empty Container Handling and Storage.

The only system currently proven and in use is the bridge crane concept in which several cranes are operated by one person. This system is currently being utilized within the Port of Singapore. And, as noted above, an early rail-mounted bridge crane concept is in operation at Matson's California marine terminals.

Fully automated or partially automated terminals typically are synonymous with high-density stacking or storage of containers. As one knows, container cargo is currently the most intermodal cargo due to its ease of handling which affects cost and time in a positive manner.

Automated terminal systems, as noted, as synonymous with high-density storage. The systems noted here in this summary describe automated container handling systems, yet to the extent that they facilitate and make possible more efficient use of container storage within maritime terminals. Some of the systems herein described are currently in use while others are still conceptual.

The following is a general listing of conceptual and currently in use automated terminal container handling systems.

[3] www.law.uoregon/edu/courses/admirlty/Articles%.../Faber-Multimodal(Converted.htm

4.3 CONCEPTUAL SYSTEMS

Conceptual systems are addressed prior to existing systems. Conceptual systems are those not fully developed yet being proposed for development either for a terminal or for a carrier. Note that there are some conceptual systems, which are being utilized to some extent within actual ports - hence, the relationship between the conceptual and existing systems. However, it is important to address the conceptual -systems first as an introduction to systems currently being utilized.

4.3.1 Robotic Handling Company

This company is located in Washington, led by Paul Dunstan and has board members including Brown and Root, SSA, Ederer Cranes, Havens Steel, GE Capital, as well as Brad Erickson of TranSystems. It is a comprehensive mechanical system that provides ship cranes, loaded container storage, empty container storage, truck and rail access, etc. At this time it has numerous patents but is at a conceptual stage. It is undercapitalized and not progressing very fast into the marketplace due to the usual issues of customer acceptance, capital risk, new much larger and extensive application of existing smaller scale systems, etc.

The overall system requires about 25 to 50 acres and is designed to handle about 1M TEU per single berth module. Cranes and mechanical systems are extensive and are designed to work along the same principles as a smaller scale automated warehouse. The cost per module is about $400 million. The primary advantage is that the system is designed to be a smaller terminal footprint and automated to reduce accidents and minimize labor costs.

Various TranSystems personnel have been involved with this "project" for approximately 10 years and has become familiar with some of the earlier studies that have been done by various groups such as CH2M HILL, Automod Simulations, Harnesfiegger Cranes, Havens Steel, Ederer Cranes, etc.

4.3.2 Computainer

The "Computainer" concept was developed by Earls Industries which also makes container spreader bars as well as mining equipment, etc. Their technology is conceptual but has had parts full scale tested. Computainer is a storage system that is designed to manage marine terminal storage operations on a smaller footprint than conventional storage systems. Stack height is 10 or more stories with each story of containers individually accessible via a rolling rack system. Costs are more moderate than other conceived systems since its only powered moving parts are the elevators that lift the containers off or on the truck than drives through the middle of the building.

4.3.3 Virginia International Terminals, Inc. – Norfolk International Terminal[4]

In 1992, Jordan, Woodman, and Dobson (JWD) along with Liftech Consultants, Inc. compared the abilities of conventional container handling equipment to the operation and capabilities of a Bridge Crane system. Bridge cranes are typically considered for operation within a maritime terminal (besides steel yards and warehouses). They are not currently utilized within the Virginia International Terminal; however, due to cost of infrastructure concerns, the report completed by

[4] "Ports '92 – Planning and Analysis of VIT's Norfolk North Terminal", American Society of Civil Engineers. July 20-22, 1992.

JWD and Liftech ("North Yard Conceptual Planning Study") shows the factors involved in their operation relative to conventional container-handling equipment.

The primary advantage noted by the "North Yard Conceptual Planning Study" is that the use of the bridge crane frees up use of the straddle carriers to perform more menial tasks; for example, moving containers between stacking sections in which ground congestion can be reduced.

Another advantage of the Bridge Crane system is its ability to move a container quicker and stack higher than a straddle carrier is typically able. As the issue (here) in higher-density container storage, the bridge crane can move more containers off the ground, freeing up additional ground either for straddle carrier or hostler circulation. As well, more land is freed up for other types of land use as less terminal space is needed.

4.3.4 Speedport[5]

A similar conceptual system to the Bridge Crane is Speedport, designed by ACTA in assocation with other consultants and advisors. Speedport is a maritime facility for which vessels dock roughly perpendicular to the shore. Located within the terminal is the storage space. Several "spiders" move between two spaces, one being the vessel docking area and the other being the storage/intermodal space, via its own rail. The spider is picked up and moves over the vessel via an overhead beam that moves from the front of the vessel to the back to position the spider(s) over containers to be unloaded (or loaded). The spider removes containers from the vessel via a spreader bar. Truck or rail cars can be waiting for loading directly from the vessel once the spider removes a box from the vessel, is lowered to its rail line, and brings the box to an awaiting truck or COFC (container on flat car). The spider can also bring the container simply to the storage stacks located in the same portion of the terminal as the truck or rail.

The overhead beam or bridge crane is supported by a columnar structure; the only moving part is the crane. The spider is also the only moving part yet, once it removes a box from the vessel, the complete spider is then lowered adjacent to the vessel onto rail where it moves to the section containing the intermodal aspects and the storage. The overhead structure in the intermodal and storage section then lifts the spider to place its box onto the stacks or onto the truck or rail car. The spider can be considered an "all-in-one" mobile spread-bar. Overhead structure is required for this system, yet it is not believed to currently be utilized anywhere within the global maritime system.

Difficulties with the system include infrastructure cost and expansion capability. It is believed that at least 16 spiders are necessary to service the vessel. Each spider is estimated to cost $500,000. Also, the terminal is pre-built or designed; expansion of the terminal would be costly as the terminal is self-contained.

4.3.5 Automated Terminal Systems

Automated Terminal Systems (ATS) is a proprietary "computerized" multiple redundant, fully automated container handling system utilizing:

- less than currently-utilized amounts of labor,
- container "A-frame" gantry cranes yet also

[5] "Measurements of Port Productivity and Container Terminal Design – a Cargo Systems report", Dolly Robinson; 1999. Also video entitled "Speedport" (Gardy McGrath; 703-620-6000).

- intermediate conveyor stations for containers to be moved from the apron to
- monobox cantilever rail mounted gantry cranes for temporary placement on the area just behind the apron or for placement onto a
- land-based mode of transportation (truck or train).

The system is being developed by Automated Terminal Systems with Purdue University for the internal system communications or programming. The system is based upon communication between the rail and truck providers and the liner services in order to improve the efficiency of the containers movement through the terminal.

The ship to shore gantry cranes are expected be automated ("new responsibilities"), are based on cranes developed by Morgan Cranes – now merged with Provincial Crane, and are expected to be able to handle at least 50 containers per hour. Current technological "manned" ship-to-shore gantry cranes would be considered the limiting factor yet the newer "un-manned"/automated ship-to-shore gantry crane is expected to no longer be a typical limiting factor.

The rail mounted gantries are based on F-Class overhead cranes utilized in the United States Steel Industry and mid-point conveyors utilized in the aluminum industry. Stacking of containers by the rail mounted gantries has been noted to be capable of 6 high or even 8 high, yet has been noted by ATS, Inc. to be capable of storage as high as that which can be engineered. The system could involve the minor use of straddle carriers or hostlers for in-yard container movement or drayage to a nearby intermodal site.

Necessary labor is noted to include maintenance personnel, a truck positioning person, rail ground crew, and a re-positioned or re-assigned crew on dock because of new "automated" responsibilities.

The current status of the system is noted to be a planned virtual simulation. Physical modeling has been noted to have been performed, yet little public information is available on this product.

4.3.6 August Design, Inc.[6]

August Design, Inc. is a developer of software and systems equipment for increasing the efficiency of maritime container terminals. August Design, Inc. has designed and built working scale models of several systems including the:

- GRAIL robotic container handling facility for Sea-Land Service, Inc.,
- Automated All-weather Cargo Transfer System (AACTS), and
- Direct Acquisition Rail to Ship (DARTS) Spreader.

4.3.7 GRAIL

This system manages and controls the movement of containerized cargo through a facility from the moment it enters the facility until it leaves. The system involves the use of overhead rail, passive switches, shuttles, container buffers, ship-to-shore cranes, a sophisticated computer control system, and robotic equipment. The system is fully automated. The "robot" can find the container that is need to be shipped. The "robot" is supposed to be able to also move containers

[6] Source: August Design, Inc. – web site material.

in order to acquire desired containers that are to be shipped. The advantages of the GRAIL system include:

- High density storage,
- Somewhat random access to densely stacked containers,
- Less gantry crane movement to load and unload vessels,
- Less time to load or unload vessels (move each container),
- Less gantry crane waiting time due to better staging processes, and
- Higher productivity.

It is not believed that this system is currently in operation.

Note that this system is a "child" of the Mono-Grail Container Handling System developed by Sea-Land Serivce, Inc., in cooperation with the Franklin Research Institute and Titan PRT Systems, Inc. The Mono-Grail System is based upon the mono-rail urban transit system. Currently, this system is believed to be only partially installed at the Sea-Land terminal in Hong Kong.[7]

4.3.8 AACTS

August Design, Inc., under funding provided by US Army-Belvoir RD & E Center as well as the Naval Surface Warfare Center Carderock Division, developed the Automated All-weather Cargo Transfer System (AACTS). AACTS utilizes robotics and an intelligent spreader bar to acquire a container from a vessel in virtually any weather condition. The system is essentially composed of a SCARA robot, a rigid hoist, and a 6-degree of freedom spreader bar. The SCARA bar is rigid but has two joints. As a result of the joints (the shoulder and elbow), the crane can move horizontally. The vertical movement is provided by the rigid hoist which can limit sway movement even in high-sea conditions. The wrist of the "arm" is provided via a slewing mechanism on the spreader bar to line up with any container, on vessel or truck (note high-sea conditions).

The primary benefit of the system is high productivity. The indirect benefits are that, this system, when used in conjunction with equipment with the ability to stack containers in a dense / high fashion, can permit a terminal to have a higher throughput and capacity than under conventional systems. See *Antwerp* under

Hong Kong

4.4 SYSTEMS CURRENTLY IN USE

4.4.1 DARTS

August Design, Inc. developed a Direct Acquisition Rail to Ship Spreader for the US Army's Military Ocean Terminal in Sunny Point, North Carolina. The spreader's primary function, as noted by its name, is to move containers directly from ship to rail. The system or spreader-bar:

- can lift any size container,
- can lift two 20-foot containers with a separation of 36 inches between them and move the containers closer together to be placed within adjacent cells on a container vessel,
- can transfer two 20-foot containers between rail cars and container vessels,

[7] "Measurements of Port Productivity and Container Terminal Design – a Cargo Systems report", Dolly Robinson; 1999. Also video entitled "Speedport" (Gardy McGrath; 703-620-6000).

- can use all four guide cells to place two 20-foot containers in 45-foot cells on container vessels, and
- uses a vision system to enable locomotive operators to position containers quickly and easily underneath the spreader-bar of the crane – minimizing movement of the crane relative to the ship's hatch within which it is working.

The benefits of the system are minimizing the need for storage and removing containers from hostler or ground (straddle carriers) can become more efficient. Again, when used in conjunction with equipment that can stack containers high, the efficiency of the entire terminal is greatly improved.

4.4.2 Visual Load

August Design, Inc. has also developed the software known as Visual Load which allows a terminal operator to view the actual movement of a container as well as create a more efficient means of storing the cargo for movement through the terminal to its next mode of transport.

4.5 Systems Currently in Use

Systems currently in use within the maritime container-cargo handling system internationally include:

- Mi-Jack Products – rubber-tired gantry cranes,
- Antwerp,
- Rotterdam AGV System,
- Port of Singapore, and
- Smartrail.

4.5.1 Fantuzzi/Reggiane

The Fantuzzi Group, which has a manufacturing agreement with Mi-Jack Products (see below) has teamed with Reggiane Products. It is not known precisely if this cooperative endeavor has produced any automated container handling systems. However, Reggiane produces marine terminal cranes for many applications; and Fantuzzi produces marine terminal lift-trucks, notably for the container handling business. Mi-jack Products and Antwerp[8]

Mi-Jack Products currently develops and markets a rubber-tired gantry crane that can stack containers 7 wide with a truck un/loading lane and 8 high. Under the same concept, the Port of Antwerp, as do other ports, utilize new-generation high-stacking dedicated ECH lift trucks. These lift trucks can handle 2 forty-foot containers at one time and stack 6 containers high.

4.5.2 Port of Rotterdam AGV System[9]

The Port of Rotterdam currently uses an Automated Ground Vehicle (AGV) system that provides near automated container movement on the ground by "conventional" vehicles. The system, while automated, provides an example of an automated system that does not allow high or dense

[8] www.mi-jack.com
[9] "Grail – High Density Automated Container Terminal", August Design, Inc. 1999.

stacking storage of containers. The system also requires wide roads which defeats the purpose of dense or high-stacking container storage— the more efficient use of land by a maritime terminal.

4.5.3 Port of Singapore[10]

The Port of Singapore manages the highest volume of containerized cargo than any other port in the world. Due to technological advances that are utilized within the Port of Singapore, greater volumes of cargo are able to pass through the Port of Singapore. PSA has been investing over $7 billion to develop 26 berths over four phases at Pasir Panjang Terminal (PPT). When fully developed, the state-of-the-art PPT will be able to handle 36 million TEUs a year. The terminal has the world's first remotely operated Bridge Cranes which will speed up container handling in the yard and further maximise yard utilization by stacking containers nine high. Built by a consortium comprising Mitsui Engineering and Shipbuilding and Keppel Engineering, these cranes will substantially boost worker productivity, by enabling each crane operator to manage a number of cranes. Benefits include that each berth can handle an average of 750,000 TEUs a year, 25% more containers than PSA's other terminals; and one person can operate several cranes.

4.5.4 Smartrail[11]

Kalmar Industries (See Corrigan under PLANNED AUTOMATED TERMINALS) has developed Rubber Tired Gantry Cranes which are equipped with "Smartrail", a satellite-based automatic steering system which makes it easier for drivers of RTG cranes to maintain the right course along rows of containers. Tests show that the precision of the system is 50 mm and has

During 1999, Smartrail RTG's were delivered to the Port of Cartagena in Columbia. "A further ten RTG cranes fitted with Smartrail were to be delivered to the container terminal in Dublin and the intermodal terminal in Antwerp. The Port of Cartagena went one step further and integrated the automatic steering with the Navis terminal system. The crane's position is checked against the main Navis computer each time the twist-lock is activated. In this way exact and clear positions are created for each container handled. When a container is later moved to another position the terminal computer is automatically informed of the new position. This makes life much easier for the drivers, but the most important benefit is having access to continuously updated positioning information, which drastically reduces the number of wrongly positioned containers.

"Smartrail has increased productivity considerably. Handling times have been reduced by 30-40 percent through the simplified verification of container positions. In addition, the speed of longer moves can be increased by up to 10 percent, so that more of Sisu machines' capacity can be utilized. Nor does Smartrail demand any drastic changes to the RTG cranes. It is easy to install the equipment on machines already in use."

4.6 PLANNED AUTOMATED TERMINALS

4.6.1 Corrigan[12]

Kalmar Industries and Sydney University's Australian Centre for Field Robotics has been developing driverless robotic straddle carriers for an automated container handling system in

[10] http://www.psa.com.sg/
[11] http://www.kalmarind.com/index.cfm?id=186&temp_id=186
[12] www.cpa.org.us/garchve2/1013.mua.html

Port Botany, Australia. While the system seems promising, reports have noted that the robotic straddle carriers are not fully functional – it seems to only go forwards and backwards. Its ability to turn has not been proven.[13]

4.6.2 Venezuela[14]

The Port of Pueblo Cabello, the largest port in Venezuela, in June of 1999, announced plans to expand its terminal, including construction of an automated container handling system. The current status is unknown.

4.6.3 Related Systems[15]

Europe Atlantic Terminal is managed by a state-of-the-art Automated Container Handling System (ACHS). The ACHS is a data transmission system for better processing of data - relative to container and cargo movement - between forwarding agents, shippers, shipowners, and consignees. Combining a system of this nature with a high-density container storage system, either conventional or conceptual, would permit high-flow container movement through a terminal.

4.7 SUMMARY

While there are currently some automated terminal systems in place and operating, not all systems are relative to high-density storage. For those systems that do assist with high-density storage, maritime ports are looking for new ways to handle containerized cargo, which is conducive to high-density storage, as a more land-efficient means of storage.

The systems noted here are both conceptual and existing. New technologies and practical engineering may prove to deliver the new methods and more efficient means of container storage that could assist ports. The Port of Singapore typically is considered a model to review for an understanding of computer-edge technology, high throughput, terminal capacity, and more automation. United State's development of automated container terminals is relatively non-existent at the moment, but redefining jobs and training of longshoremen for new technologies is on the horizon.

[13] "The Guardian" (www.cpa.org/au/garchve2/1013mua.html), August 16, 2000.
[14] www.tradeport.org/ts/countries/venezuela/mrr/mark0139.html
[15] www.gmportuaire.fr/picture.htm

EXPERT OPINIONS

Wetlands Determination at Bayport Site

prepared for GBCPA

11B. Expert Opinion - Dr. John Jacob

11C. Expert Opinion - Lawrence G. Dunbar, P.E.

Expert Opinion

John S. Jacob, Ph.D.
Professional Wetland Scientist, Certified Professional Soil Scientist

Wetland extent and significance at the proposed
Bayport Channel Container/Cruise Terminal site

January 2002

Main Report – Extent of Wetland Complexes, their Adjacency to Waters of the United States, and Resulting Water Quality Benefits

EXECUTIVE SUMMARY

The proposed Bayport site contains well over 100 acres of a unique prairie-pothole wetland complex that represents an irreplaceable geologic legacy.

Based on the Draft Environmental Impact Statement (DEIS), it is not possible to make an accurate assessment of the impact of wetland loss at this site, nor can an impartial comparison of the relative impacts be made between the Bayport site and the alternate sites. The wetland coverage at the Bayport site represented in the DEIS was determined through aerial photo interpretation. The DEIS does not contain maps or data supporting the final jurisdictional determination. A comprehensive delineation is warranted given the large potential impacts, and therefore a more serious and detailed study of the impact site is needed.

Further, and most importantly, the DEIS incorrectly represents the adjacency of many of these wetlands to waters of the United States, and therefore the jurisdiction of regulatory agencies. The DEIS does not apply the current Corps' Galveston District criteria for wetland adjacency correctly to either the DEIS aerial photo interpretation or to other existing data sources, including those field delineated. Therefore, wetlands with a hydrologic connection to waters of the U.S. (Pine Gully and Galveston Bay), as well as wetlands within the 100-yr floodplain, are not analyzed as adjacent, and therefore jurisdictional, in the DEIS. Though not represented as such in the DEIS, the Corps' own criteria clearly states that these wetlands are adjacent, and therefore jurisdictional.

Finally, this pothole complex has surface water connections to Galveston Bay and/or its tributaries, and thus is an important contributor to clean water in the Bay. The Corps' own hydrologic data in the DEIS proves that all land parcels on the site drain to a water of the United States. Regardless of whether runoff occurs through wetlands and a tributary system, or via overland flow through other wetlands, the DEIS does not discuss the water quality implications to waters of the U.S of filling these special aquatic sites.

For more information on the uniqueness and significance of the wetland assemblage at the Bayport site, please refer to Appendix 1 of this expert report.

photo interpretation. A graphical comparison of these results appears in the next section below, while an acreage comparison appears in the following table.

Table 1: Comparison of Wetland Acreage Totals

	Bayport DEIS		Shoal Point DEIS[1]		Berg Oliver (1998)[2]	
Site	Jurisdictional	Total	Jurisdictional	Total	Jurisdictional	Total
Spillmans Island	3	207	3	3		
Bayport	2.5	104	3	38	N/A	118
Shoal Point	13	142	13	13		

[1]Even though the Shoal Point DEIS uses a smaller footprint at each alternative for its proposed container facility, this fails to explain the difference in acreage when the data and footprints from the two DEIS's are compared.
[2] The Berg-Oliver 1998 determination does not include a tract of land known as the "Seureau Property" which is shown as part of the cruise terminal in the Bayport DEIS.

2. Adjacency Issues

On January 9, 2001, the United States Supreme Court ruled, in *Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers*, that intrastate waters, including isolated wetlands, which could affect interstate commerce solely by virtue of their use by migratory birds, are no longer considered waters of the U.S.

DEIS pages 3.19-2 to 3.19-3 set out the Galveston District's revised, post-SWANCC "adjacency" definition. This definition highlights four criteria used to determine adjacency. Of particular importance here are the "100-yr floodplain" and "hydrologic connections" criteria.

> 100-yr Floodplain: It is reasonable to consider wetlands that lie within the 100-year floodplain as adjacent. However, it should be noted that sheet flow over land, outside a floodplain is not considered a sufficient hydrologic connection.
>
> Hydrologic Connections: Relationships between navigable water, or a surface tributary system, must exist to be considered adjacent. Otherwise, the wetland is considered isolated. Examples of hydrologic connections include surface tributary systems, surface water connections such as a stream, continuous wetland system, ditch, or other watercourse that carries water from a water body to navigable waters, or waters that are part of a surface tributary system, during normal expected flows or predictable flood events.

in the 100-year floodplain was calculated using the internal calculator of ARCGIS. The figures were cross-checked with approximate hand calculations.

Of the wetlands identified by air photo interpretation in the DEIS, 8.8 acres are coterminous with the FEMA 100-year floodplain (Fig. 8). In the LAN report, 22.0 acres of wetlands would likewise be considered jurisdictional under the Galveston District policy shown in the DEIS (Fig. 9). For the field-verified Berg-Oliver (1998) delineation, 5.52 acres are contained in the 100-yr floodplain, and would therefore merit a jurisdictional claim (Fig. 10). The NWI wetlands were not evaluated since they are based on lower-resolution images and provide only a rough estimate of total acreage.

B. Hydrologic connections established through recent ditching

Aerial photo interpretation also demonstrated the presence of an extensive series of ditches dug in and through many of the potholes on the Bayport property tract south of Port Road (Figs 11-14). Based on these photos, the ditches were dug sometime between late 1991 and 1993, apparently in an attempt to drain the wetlands. This investigator visited the site in 1992 as a subconsultant to Jones and Smith consultants and was informed by them that that was indeed the intent of the landowners at that time. Many of the ditches skirted the edges of the potholes, perhaps dug that way in the apparent belief that the wetlands could be legally drained on the edges without violating the Clean Water Act. But many of these ditches run through the middle of the potholes, either in an attempt to directly drain the wetlands, or simply in ignorance of the true wetland boundaries.

Regardless of the intent, the effect has been to establish a direct linkage to Pine Gully and thus the bay for the 600-acre central area of the Bayport site (Fig. 15). These ditches have since been recognized on the latest USGS topographic maps as being part of the local and permanent drainage system (Fig. 16-17). Both the aerial interpretation ditches and the USGS ditches pass through a significant acreage of wetlands, whether they are defined in the DEIS, LAN report, or Berg-Oliver field survey (Figs. 18-23). While the ditches certainly modified the hydrology of the affected wetlands, the impact was not enough to totally remove wetland hydrology, as evidenced by the observed tonal patterns on the 1995 aerial photograph (Fig. 13).

Table 3 below shows the acreage of wetlands at Bayport, south of Port Road, that have hydrologic connections to waters of the U.S. through the expert interpreted and USGS hydrography described above, for the LAN, Berg-Oliver, and DEIS delineations

Table 3 – Wetlands connected to waters of the U.S. by recent drainage alterations on the Bayport property south of Port Road

Delineation	Acreage, Expert interpretation (rounded)	Acreage, USGS hydrography (rounded)
LAN 1998	78	54
Berg Oliver 1998	58	41
DEIS 2001	22	14

habitat but no surface water or other flows into interstate waters such as Pine Gully or Galveston Bay. USACE considers these wetlands isolated and therefore, apparently in an excessively broad reading of *SWANCC*, non-jurisdictional under any circumstances.

The issue at hand, however, is not *SWANCC* or the legality of the Galveston District's current policy but rather the issue of USACE using its current policy properly to identify adjacent wetlands. In this investigator's opinion, that has not occurred.

Based on the USACE current stated policy, there is no basis for the 2.475-acre figure shown on the revised permit application dated October 31, 2001 and shown in the DEIS. The use of a figure implying precision to a thousandth-of-an-acre with out any documentation calls into question the methodology used to come up with this figure.

3. Water Quality

A. The DEIS fails to discuss water quality impacts and lessened environmental values from wetland loss

In many cases, impacts from wetland loss for the proposed Bayport alternative site shown in DEIS figure 3.19-7 are not discussed or are discussed inadequately in the DEIS. The DEIS hydrologic analysis shows 650 ac-ft of mean annual runoff from the largest tract at the proposed Bayport site, which contains numerous wetland complexes hydrologically connected to waters of the United States. Mean annual runoff figures are not provided for other portions of the Bayport site, an error a supplemental DEIS should correct[3].

Without such data, a decision-maker cannot determine the water quality benefit to waters of the United States that would be lost when the upland area is filled – particularly if the upland area contains significant wetland complexes, as the Bayport site does. The DEIS has not analyzed the impact of losing these water quality benefits.

The prairie pothole wetland complex at the Bayport site greatly modifies the quality of the water flowing through them. The water-cleansing qualities of these kinds of wetlands are precisely the reason they are regulated under the Clean Water Act. Additionally, nitrogenous compounds comprise a substantial portion of the pollution entering Galveston Bay. These compounds are virtually removed as runoff passes through wetlands.

The filtration qualities of the wetland vegetation and the particular geochemistry of wetlands (Mitsch and Gosselink, 2000; Schlessinger, 1991) cleans water that passes through the wetlands such that water that leaves them is very often much cleaner than that which enters (Kadlec and Knight, 1995). Landscapes with significant wetland components will thus generally have a much cleaner runoff than landscapes without wetlands. In addition, prairie pothole wetlands act as significant flood control buffers because they are natural detention

[3] According to recent work conducted at similar sites in the region by Andy Sipocz of the Texas Parks and Wildlife Department, at a minimum, 70% of the runoff from the entire Bayport site could be expected to flow through wetlands (Sipocz, A. 2002).

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PROFESSIONAL INTERESTS

Runoff Pollution, Watershed Management, Sustainable Urban Development, Wetlands, Environmental Impact Assessments, Natural Resource Mapping and Assessment, Soil Science,

EDUCATION

1992 **Ph.D.** Pedology, Texas A&M University. Dissertation: "The Agroecological Evolution of Cobweb Swamp, Belize."

1984 **M.S.** Soil Science (Pedology and Mineralogy), Texas Tech University. Thesis: "Persistence of a Zeolite in Tuffaceous Soils of the Texas Trans-Pecos."

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EMPLOYMENT AND CONSULTING RECORD

1997-prsnt **Extension Environmental Quality Specialist, Texas A&M Sea Grant and Texas Cooperative Extension.** Coastal Specialist for water quality and environmental issues. Urban Sustainability. Watershed management. Runoff pollution education and abatement. Environmental quality education. Wetlands resource protection and management.

1996 **Senior Environmental Scientist, Fugro International, Inc. Houston, Texas.** Environmental impact assessments, oil and gas operations in South America. Base line assessments of tropical rainforest environments, including soils and land use, biological inventories, and water quality assessments. Impact evaluation and ranking, environmental management and mitigation plans. Major field work in Bolivia and Ecuador in Upper Amazon basin. Wetland Delineation and Permitting on Texas Gulf Coast and East Texas. Design of wetland mitigation projects.

1995-1996 **Research Fellow, Environmental Institute of Houston, University of Houston-Clear Lake** Development of a wetland preservation plan for Greater Houston area, involving extensive remote sensing interpretation and community networking. Teach graduate course in Wetland Geoecology. Environmental short courses in Wetlands and Environmental Site Assessment.

1994-1995 **Assistant Training Specialist, Texas Engineering Extension Service.** Responsible for environmental short courses. Developed courses on wetland delineation and soil and groundwater remediation. Developed geology and soil modules for environmental site assessment courses. Taught chemistry and toxicology portions of hazardous materials courses. Development of environmental contacts in Mexico. Established working relationship with Instituto Tecnológico y de Estudios Superiores Monterrey ("Monterrey Tech").

1987- **Research Associate**, Texas A&M University. Supervisor, Soil Characterization

1983 Lubbock, Texas. Advanced chemical and mineralogical analyses of soils. Research towards completion of Masters degree. Research of mineral stability in volcanic soils of the Texas Trans-Pecos.

1973-1979 **Staff Sergeant**, United States Air Force, Reese AFB, Lubbock, Texas. Managerial and supply experience in dental clinic. Coordination of preventive dentistry programs for public. Supervised up to 5 subordinates.

1971-1973 **Field Promoter**, Alma de Centroamerica, Guatemala City, Guatemala. Principal field promoter in highland strawberry project. Provided technical assistance on cultivation and irrigation. Formation of producer cooperatives. Development of market strategies.

TEACHING EXPERIENCE

Web-Based Soil and Site Evaluation Basic Introduction. 8-hr CEU credit course for the On-site sewage facility program.

Soil and Site Evaluation: One-day course, taught at least 10 times, TAEX, 1997-2001.

The Geoecology of Wetlands: 3-hour graduate course, taught 2 semesters (University of Houston - Clear Lake, 1995 and 1999).

Introductory Soil Science: 1-hour laboratory undergraduate course, taught 1 semester (Texas A&M University).

Wetland Delineation Certification Course: 40-hour short course, taught 8 times (Texas Engineering Extension Service and University of Houston - Clear Lake).

Environmental Site Assessment, Phase I (Investigation): 30-hour short course, taught 3 times (Texas Engineering Extension Service).

Environmental Site Assessment, Phase II (Sampling): 30-hour short course, taught 5 times (Texas Engineering Extension Service).

PERSONAL

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PROFESSIONAL AFFILIATIONS

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Nordt, L.C., J.S. Jacob, and L.P. Wilding. 1991. **Map unit composition and quality assurance in soil survey.** *In* L.P. Wilding and M. Mossbauch (ed.). Spatial variabilities of soils and landforms. Soil Science Society of America Special Publication No. 28. Madison, WI.

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Archaeological pedology in the Maya lowlands. J.S. Jacob. Invited paper, special symposium on Pedological Perspectives in Archeological Research, Soil Science Society of America annual meetings, November 1993, Cincinnati, OH.

Late Quaternary landscape evolution and paleoenvironments in the Medina River valley, South-Central Texas. R.D. Mandel, L. Nordt, and J.S. Jacob. Association of American Geographers 91st Annual Meeting, Chicago IL, 1995.

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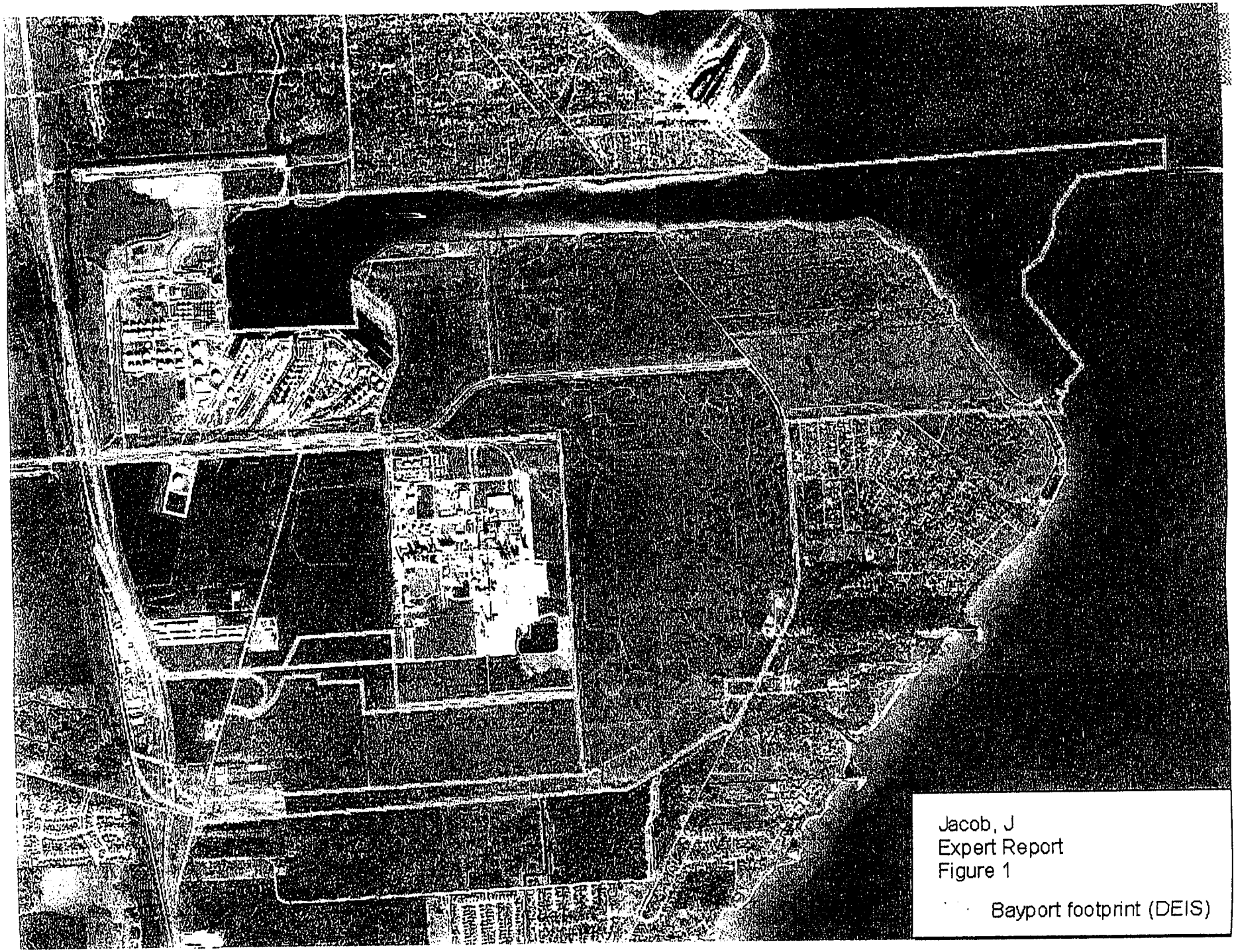
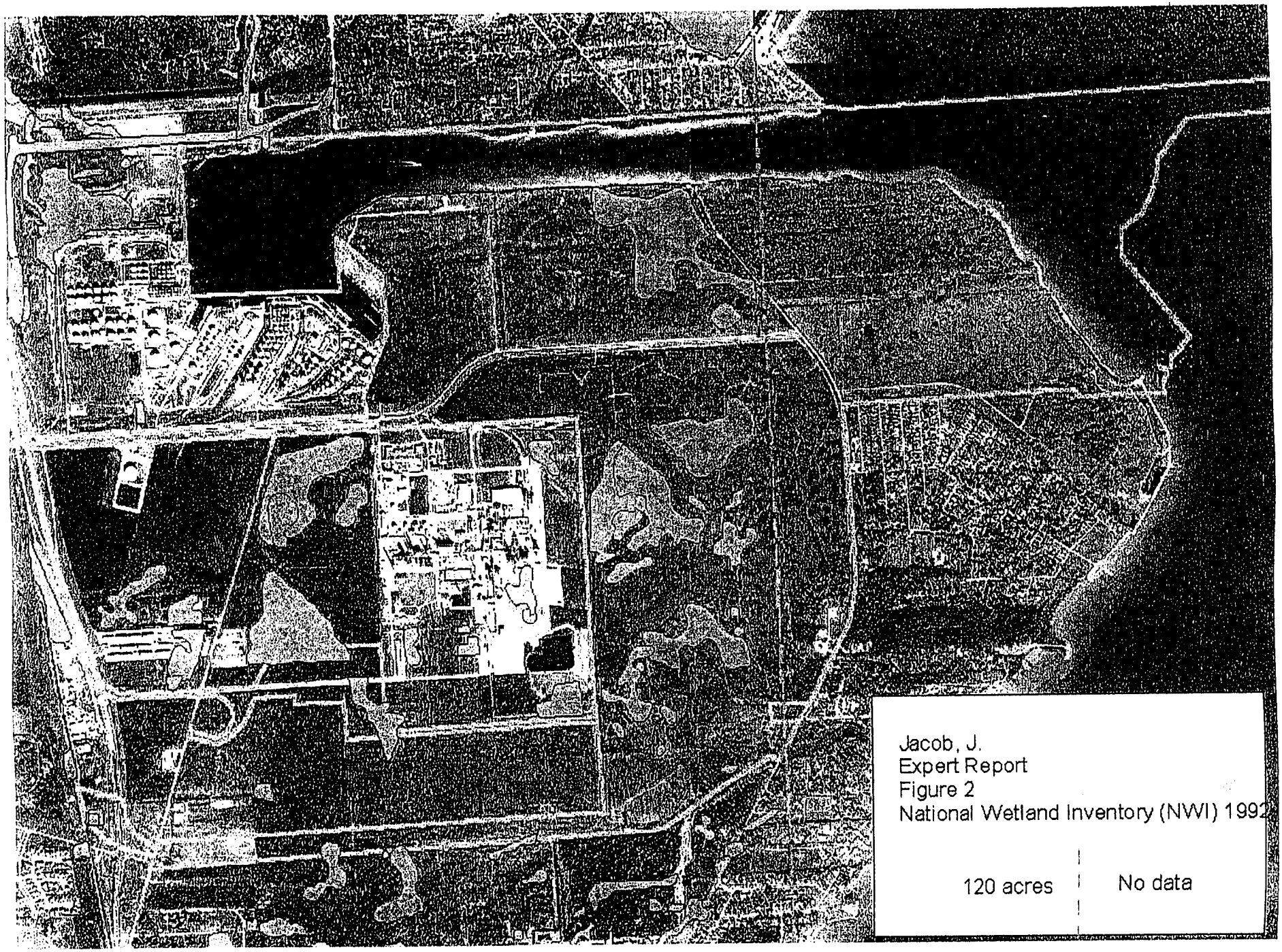
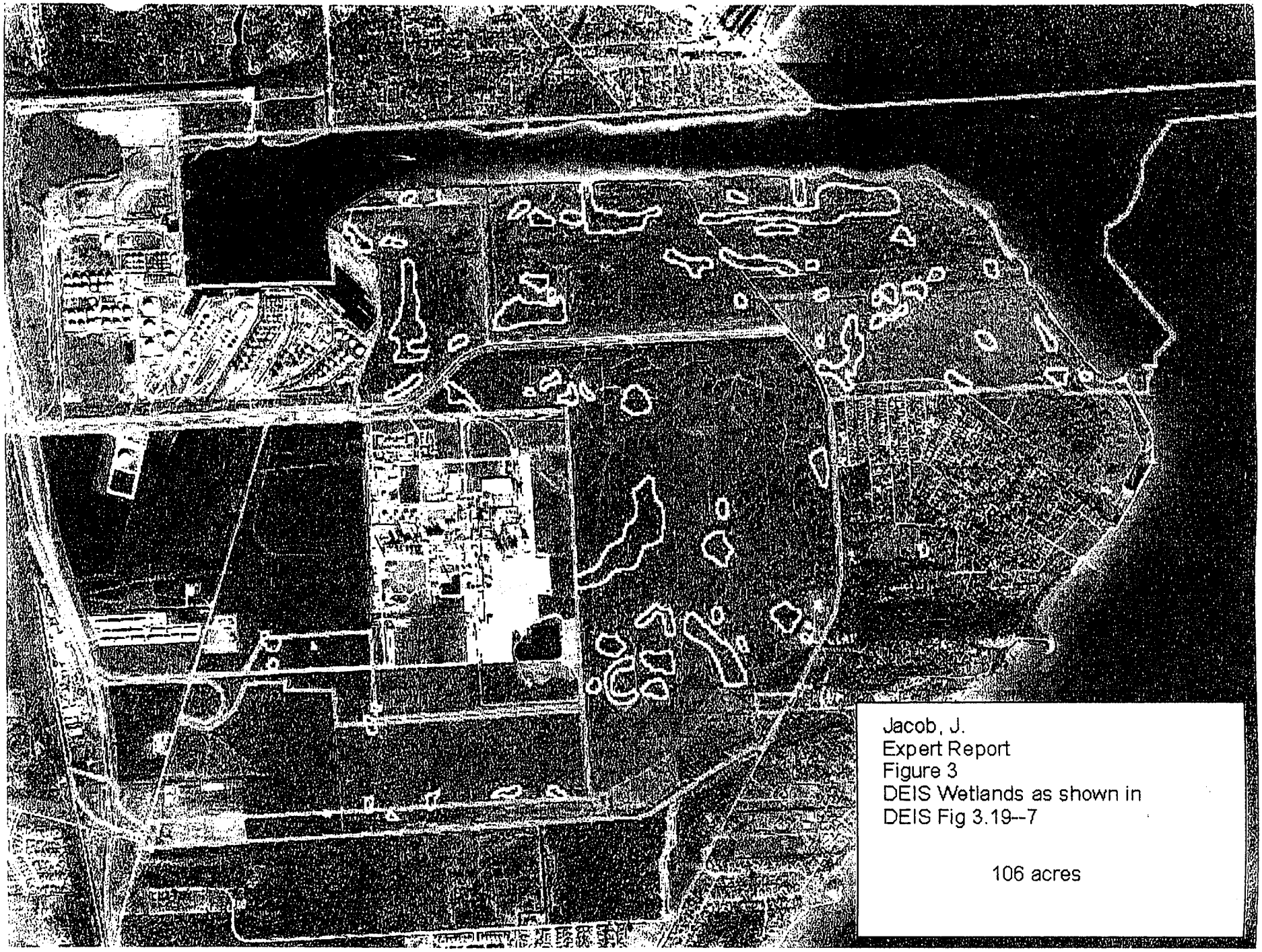


Jacob, J
Expert Report
Figure 1

Bayport footprint (DEIS)

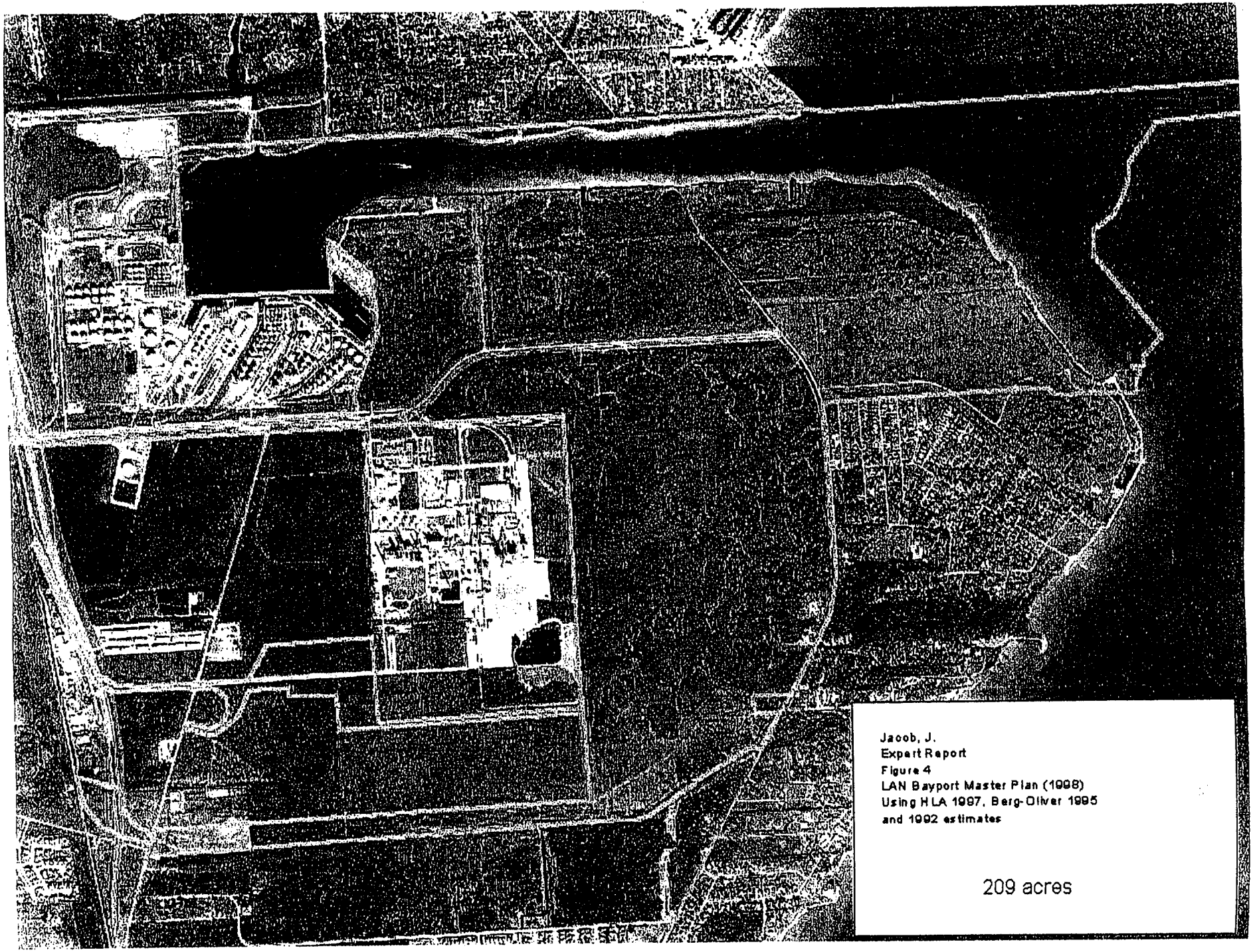


Jacob, J.
Expert Report
Figure 2
National Wetland Inventory (NWI) 1992



Jacob, J.
Expert Report
Figure 3
DEIS Wetlands as shown in
DEIS Fig 3.19--7

106 acres



Jacob, J.
Expert Report
Figure 4
LAN Bayport Master Plan (1998)
Using HLA 1997, Berg-Oliver 1995
and 1992 estimates

209 acres

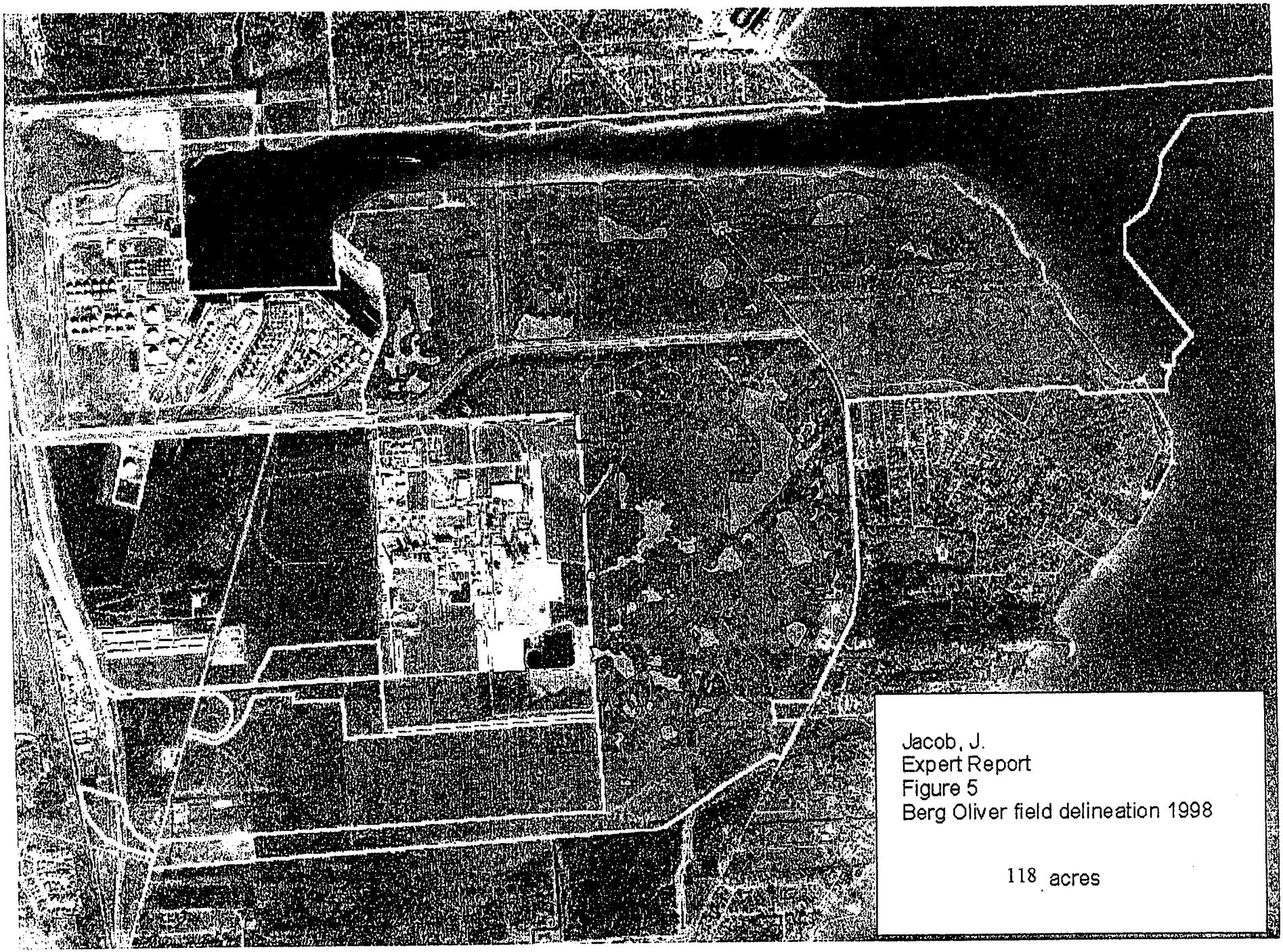


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Figure 5
Berg Oliver field delineation 1998

118 acres

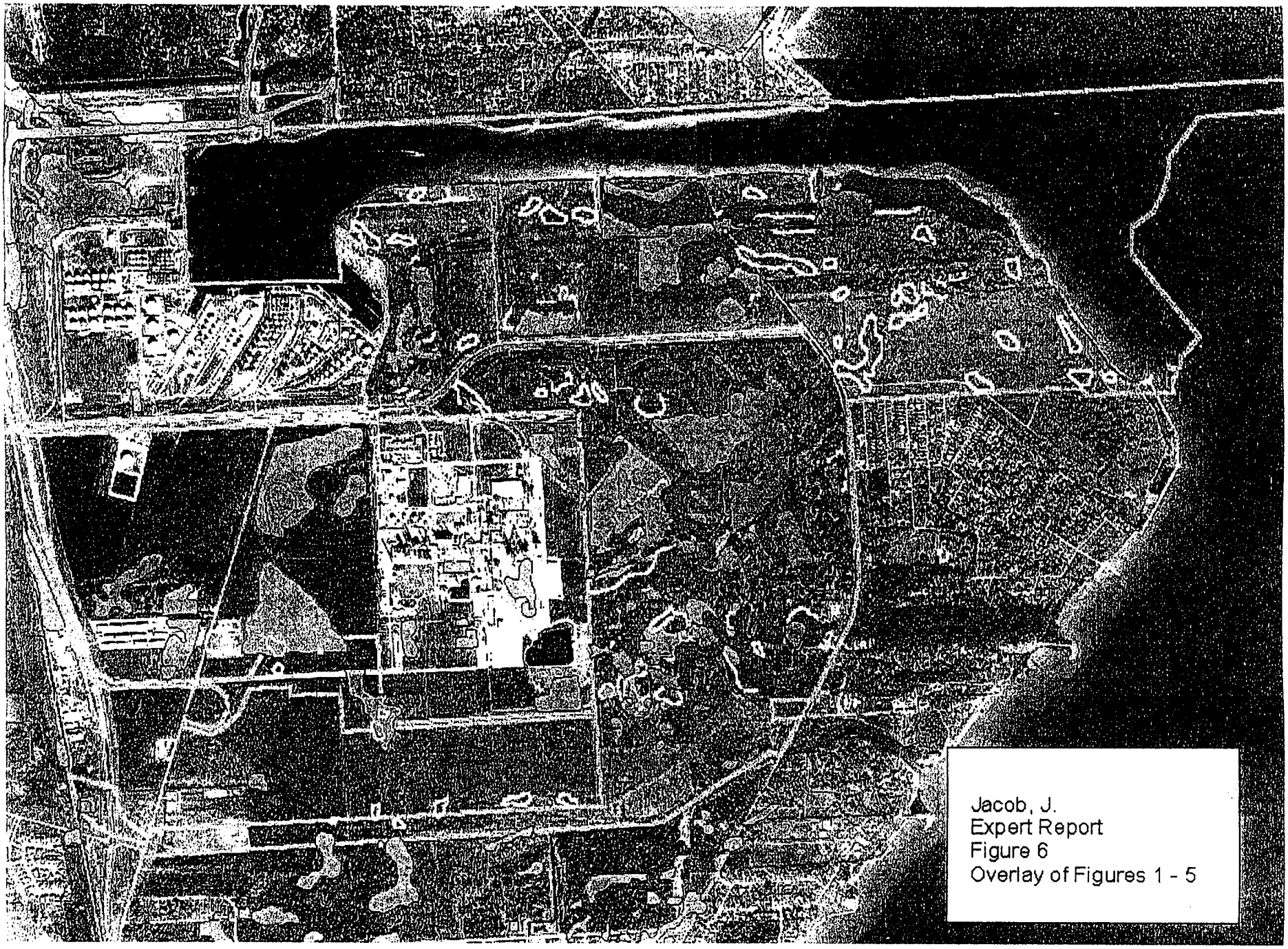

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Figure 6
Overlay of Figures 1 - 5

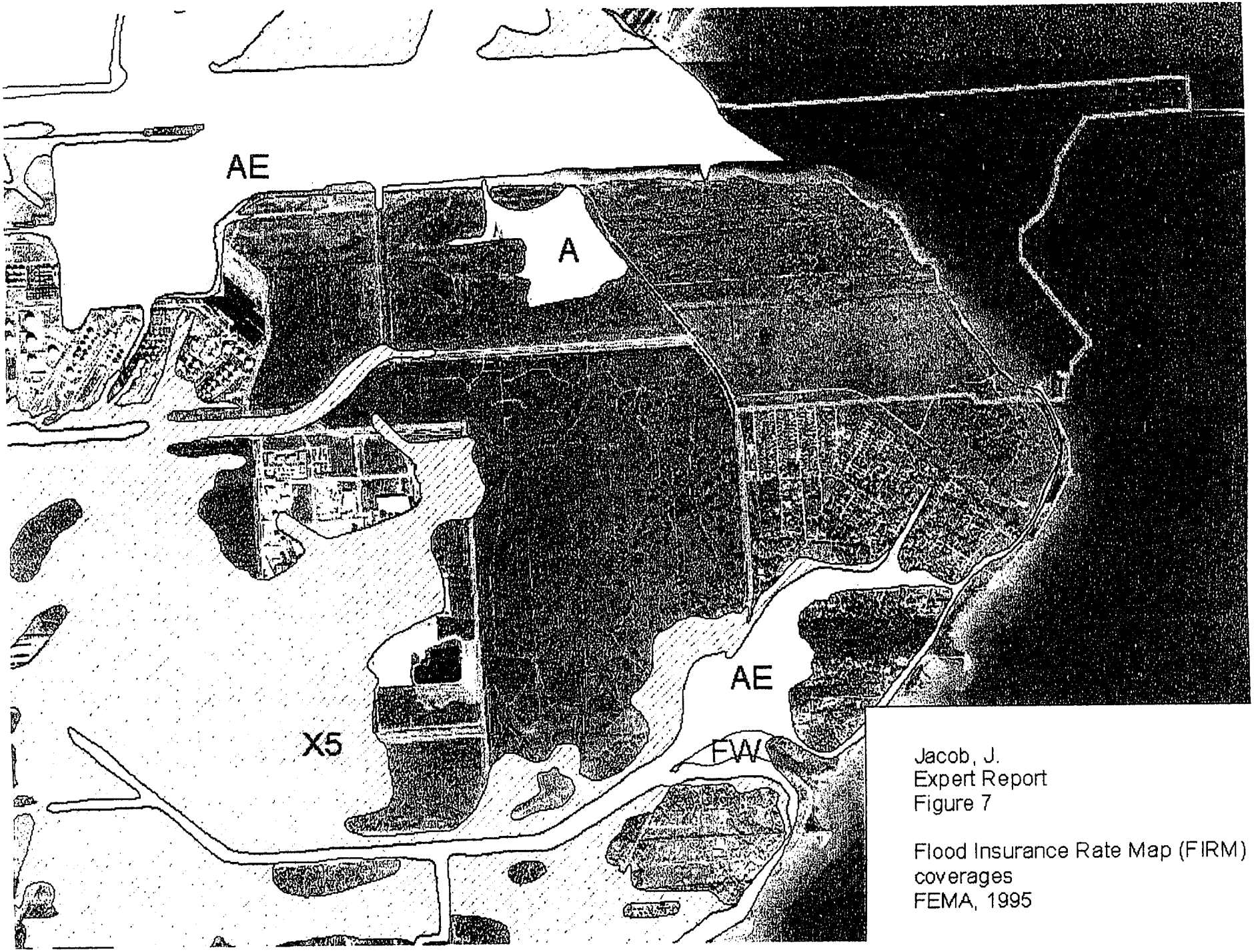

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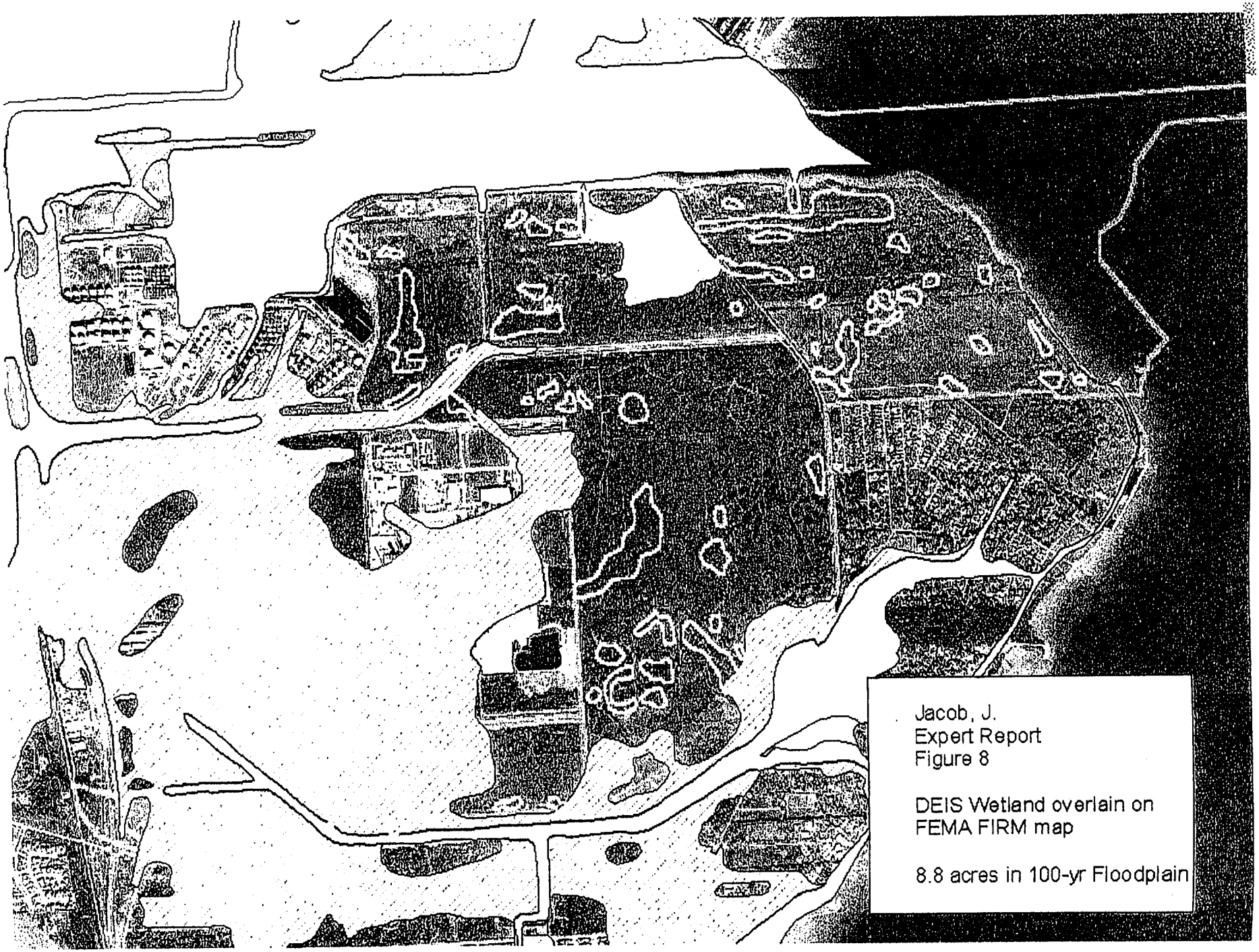
Figure 7

Flood Insurance Rate Map (FIRM) coverages
FEMA, 1995



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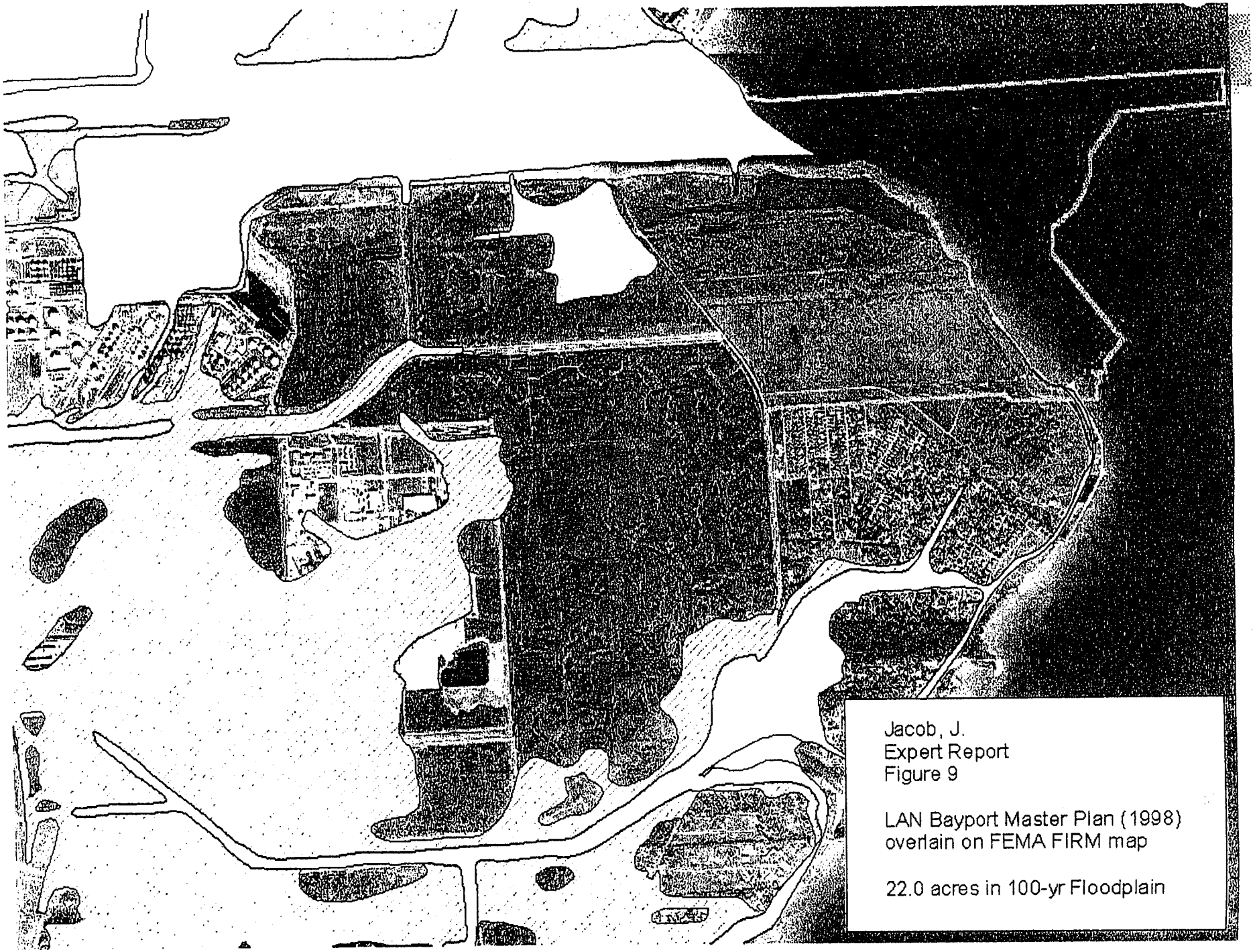
Expert Report
Figure 8

DEIS Wetland overlain on
FEMA FIRM map

8.8 acres in 100-yr Floodplain



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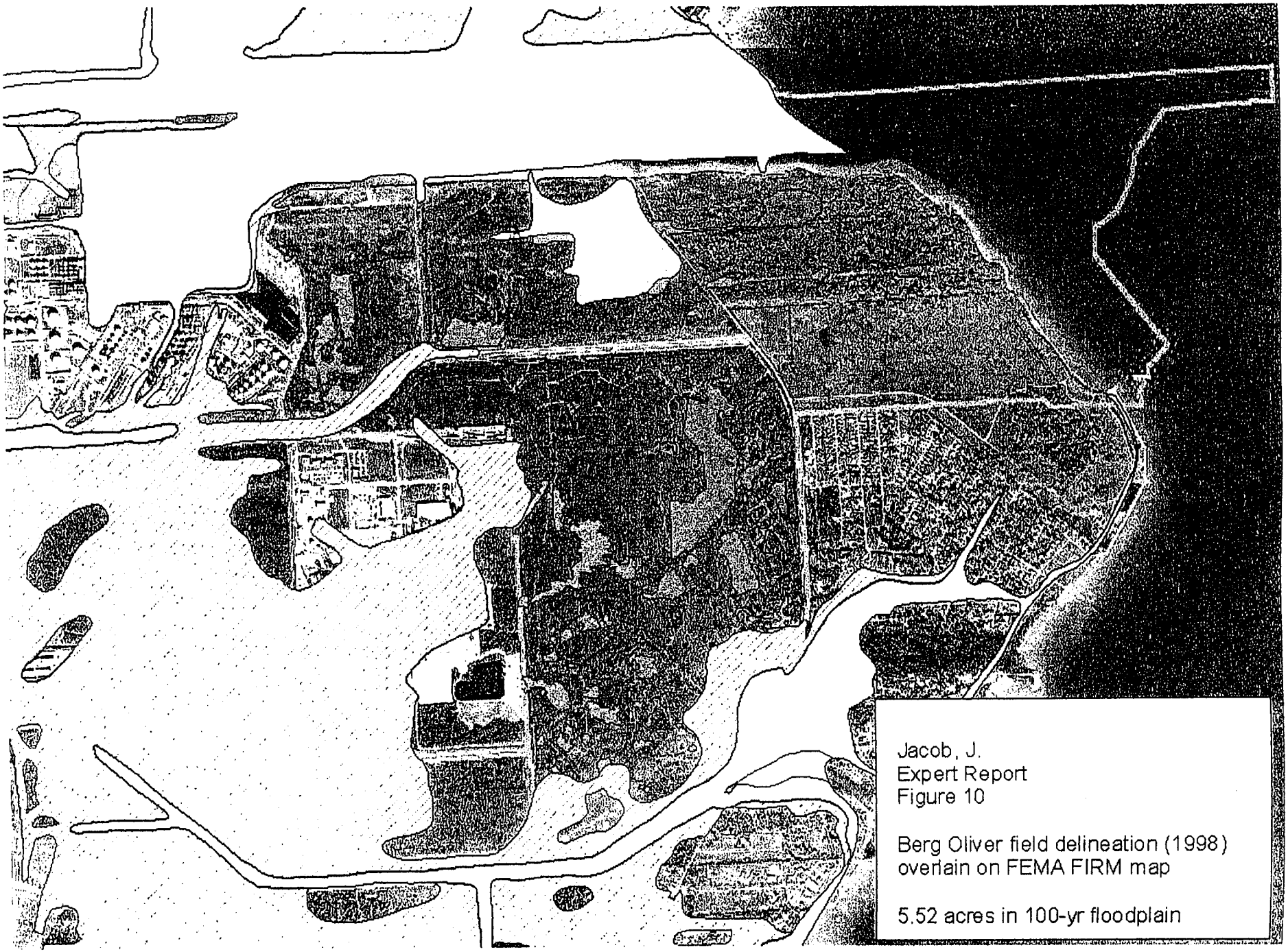
Expert Report
Figure 9

LAN Bayport Master Plan (1998)
overlain on FEMA FIRM map

22.0 acres in 100-yr Floodplain



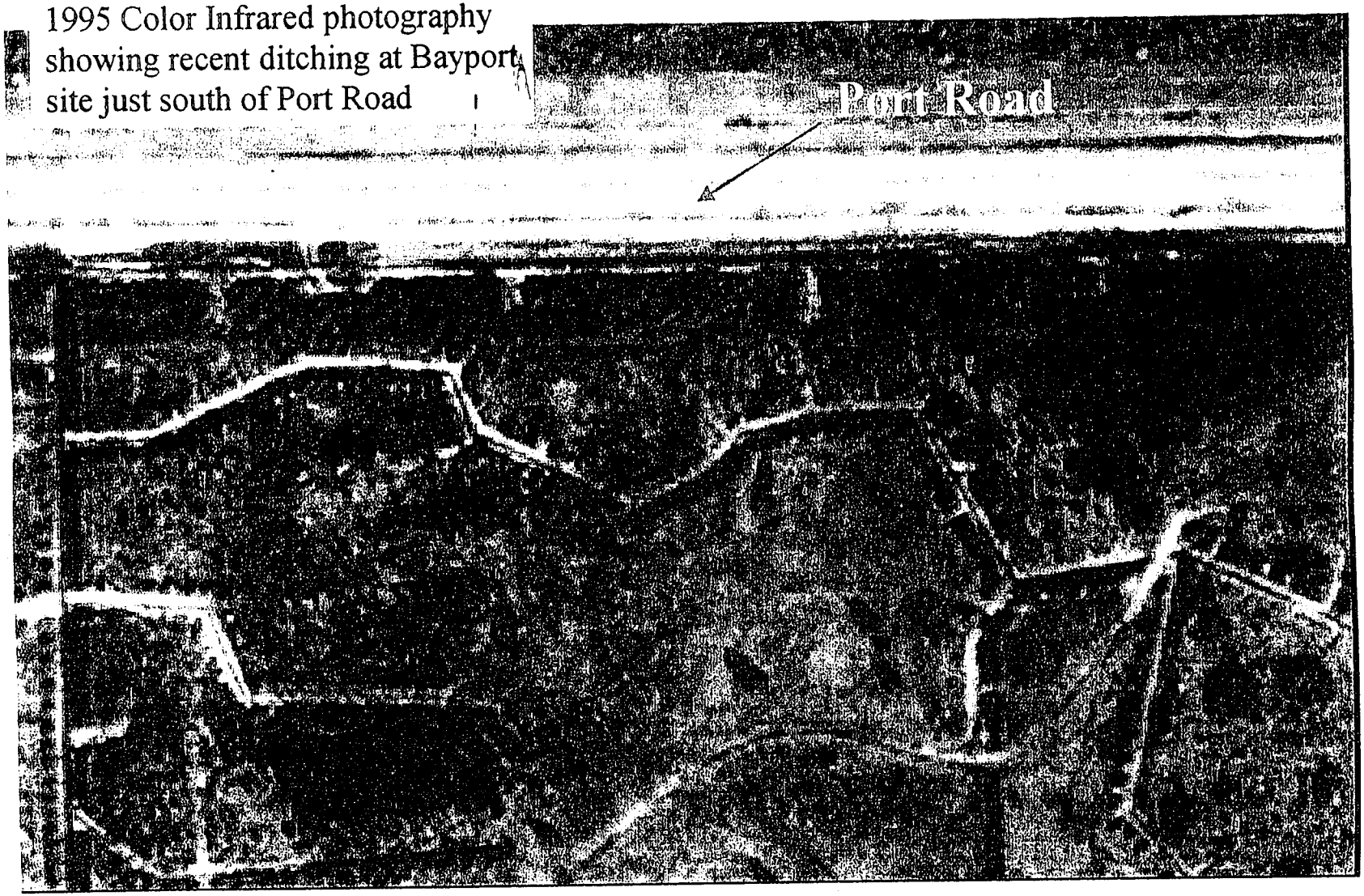
Jacob, J.
Expert Report
Figure 10

Berg Oliver field delineation (1998) overlain on FEMA FIRM map

5.52 acres in 100-yr floodplain

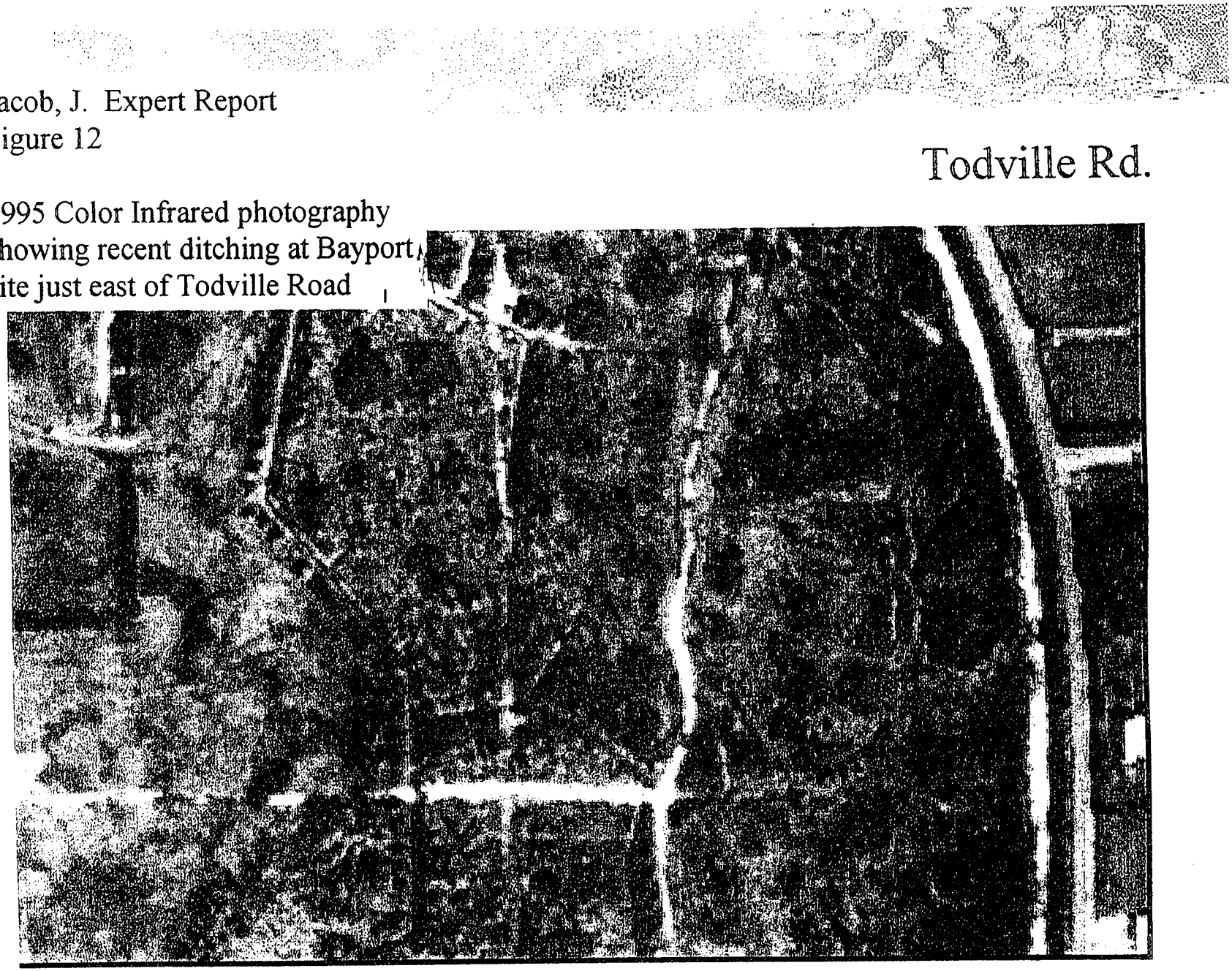
Jacob, J. Expert Report
Figure 11

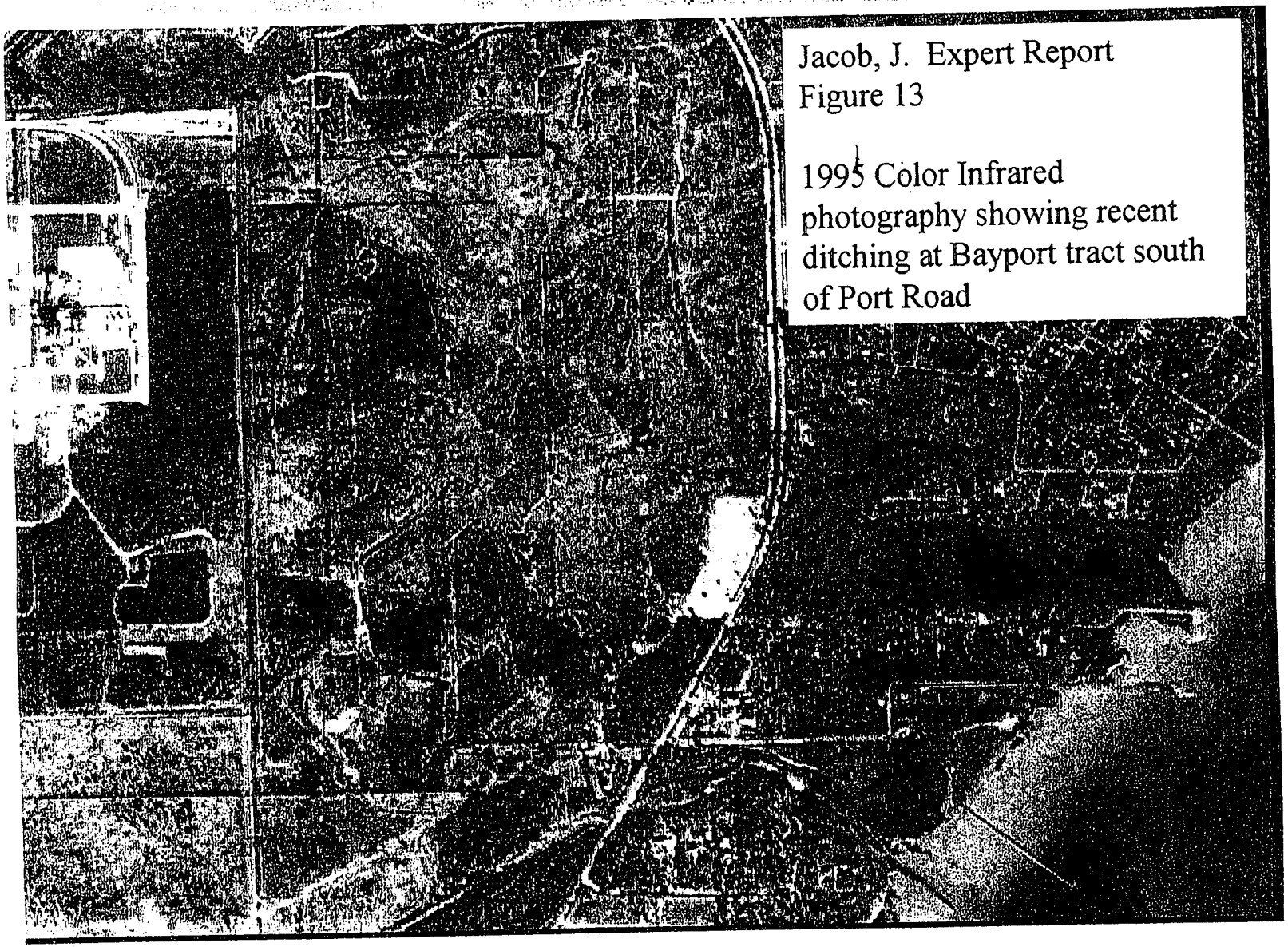
1995 Color Infrared photography showing recent ditching at Bayport site just south of Port Road



Jacob, J. Expert Report
Figure 12

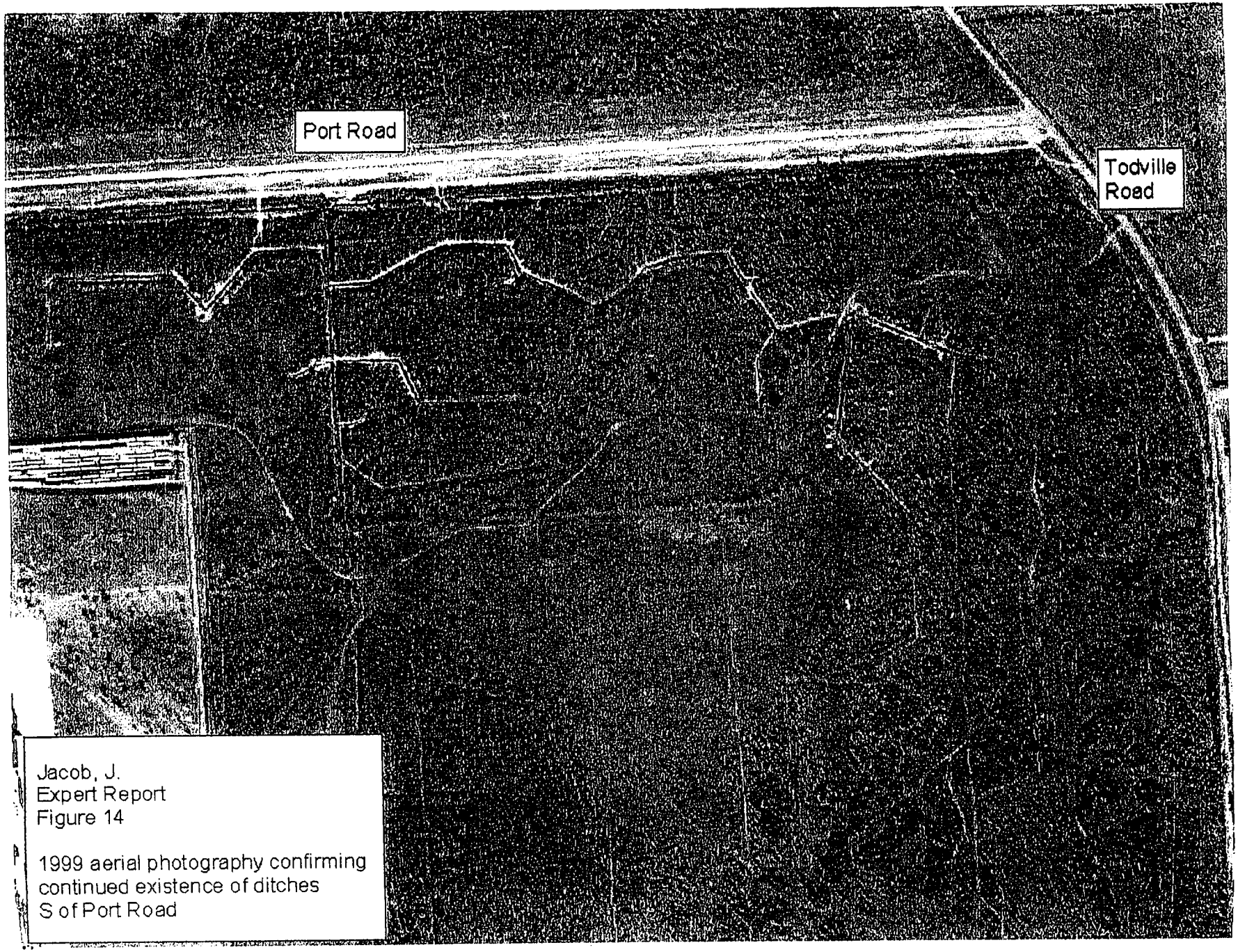
1995 Color Infrared photography
showing recent ditching at Bayport
site just east of Todville Road





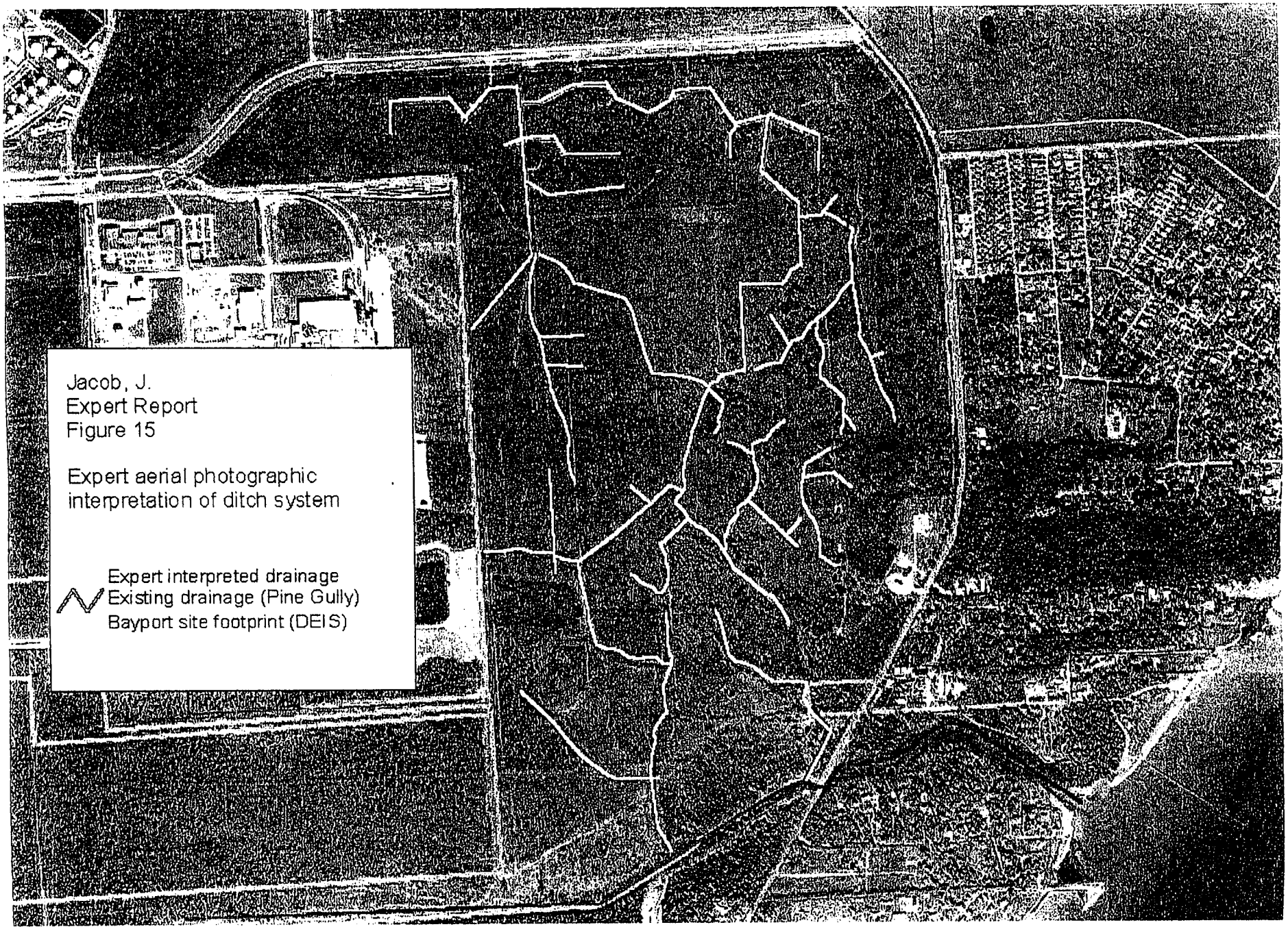
Jacob, J. Expert Report
Figure 13

1995 Color Infrared photography showing recent ditching at Bayport tract south of Port Road

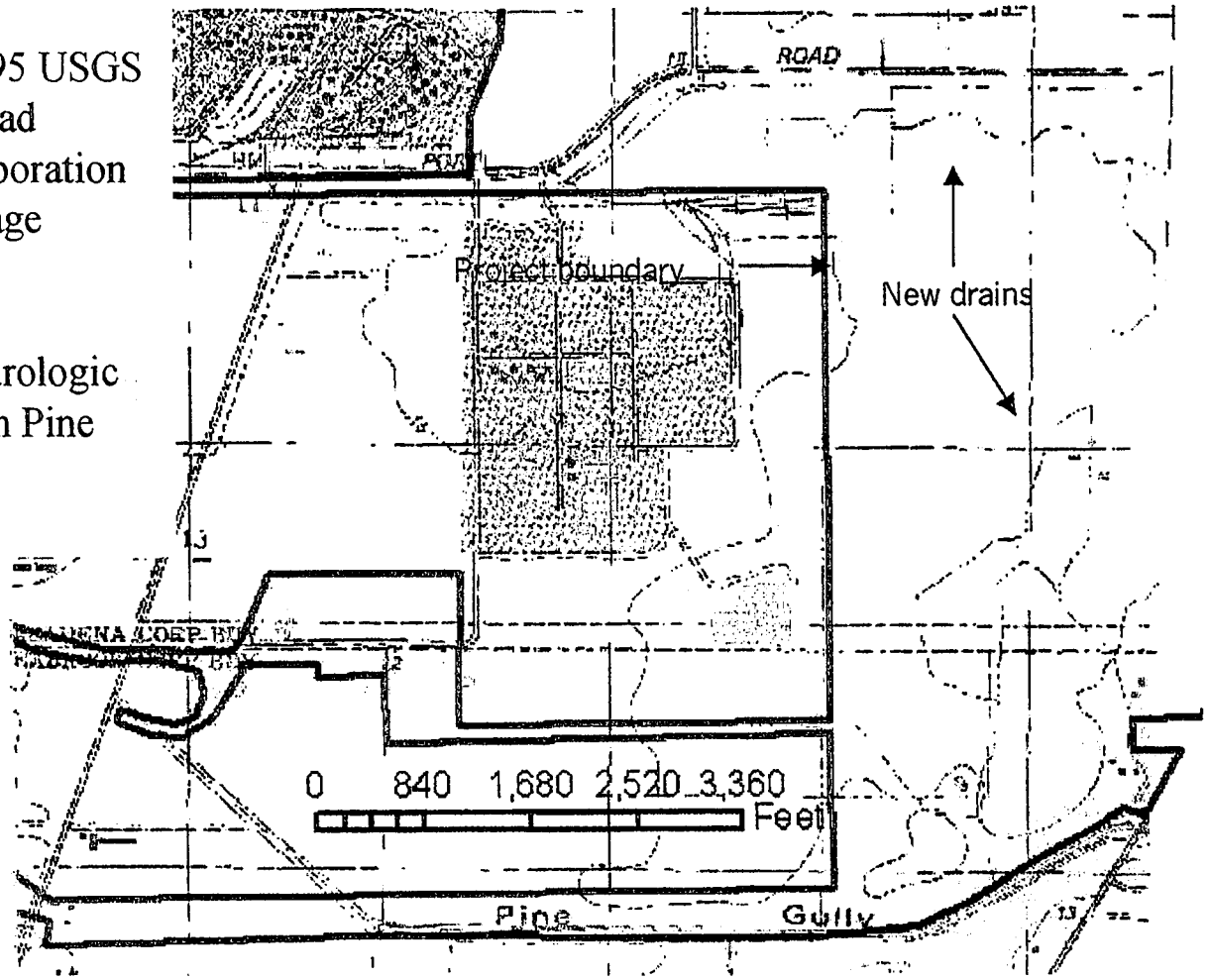


Jacob, J.
Expert Report
Figure 14

1999 aerial photography confirming continued existence of ditches S of Port Road

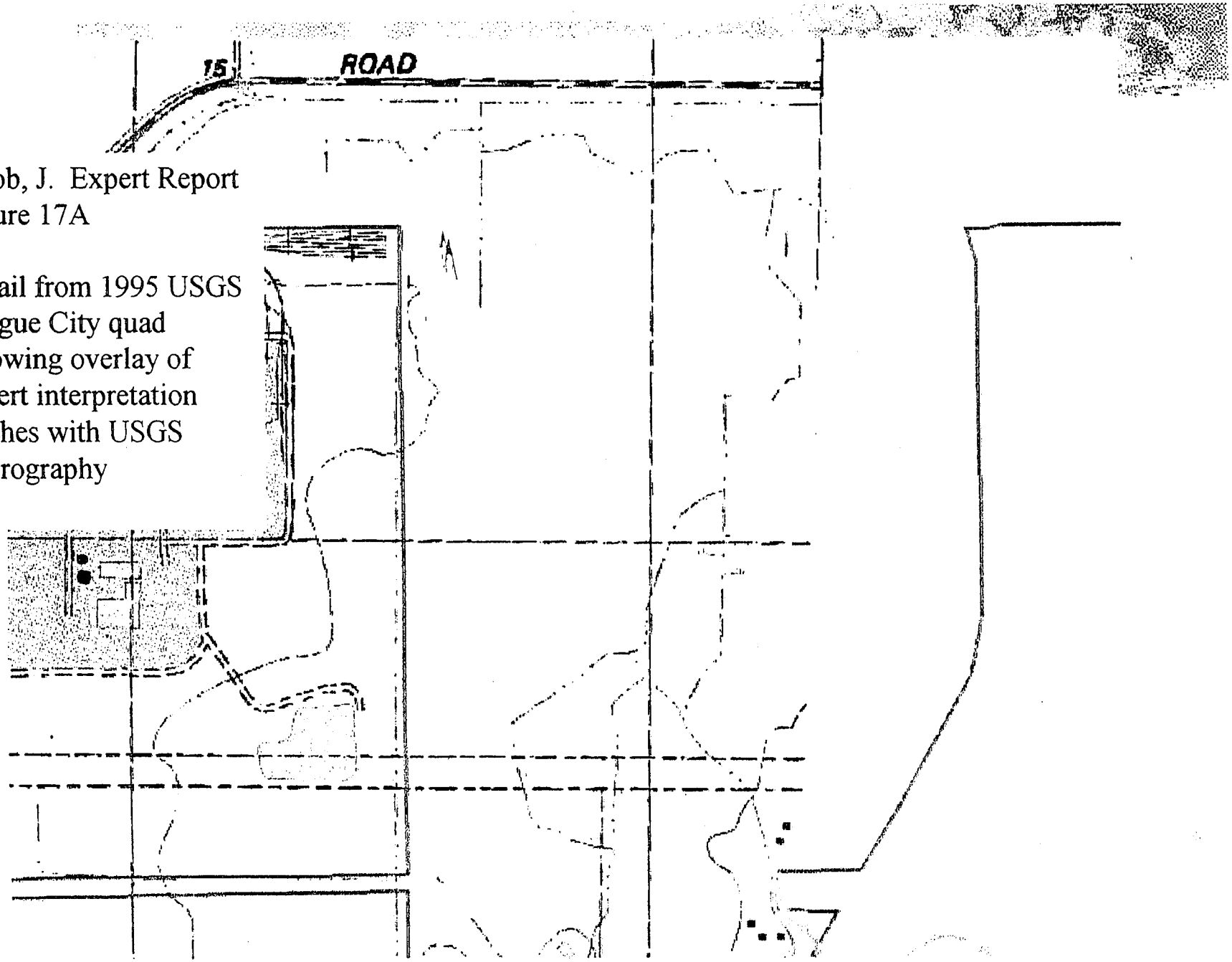

Jacob, J.
Expert Report
Figure 15
Expert aerial photographic interpretation of ditch system
Expert interpreted drainage
Existing drainage (Pine Gully)
Bayport site footprint (DEIS)

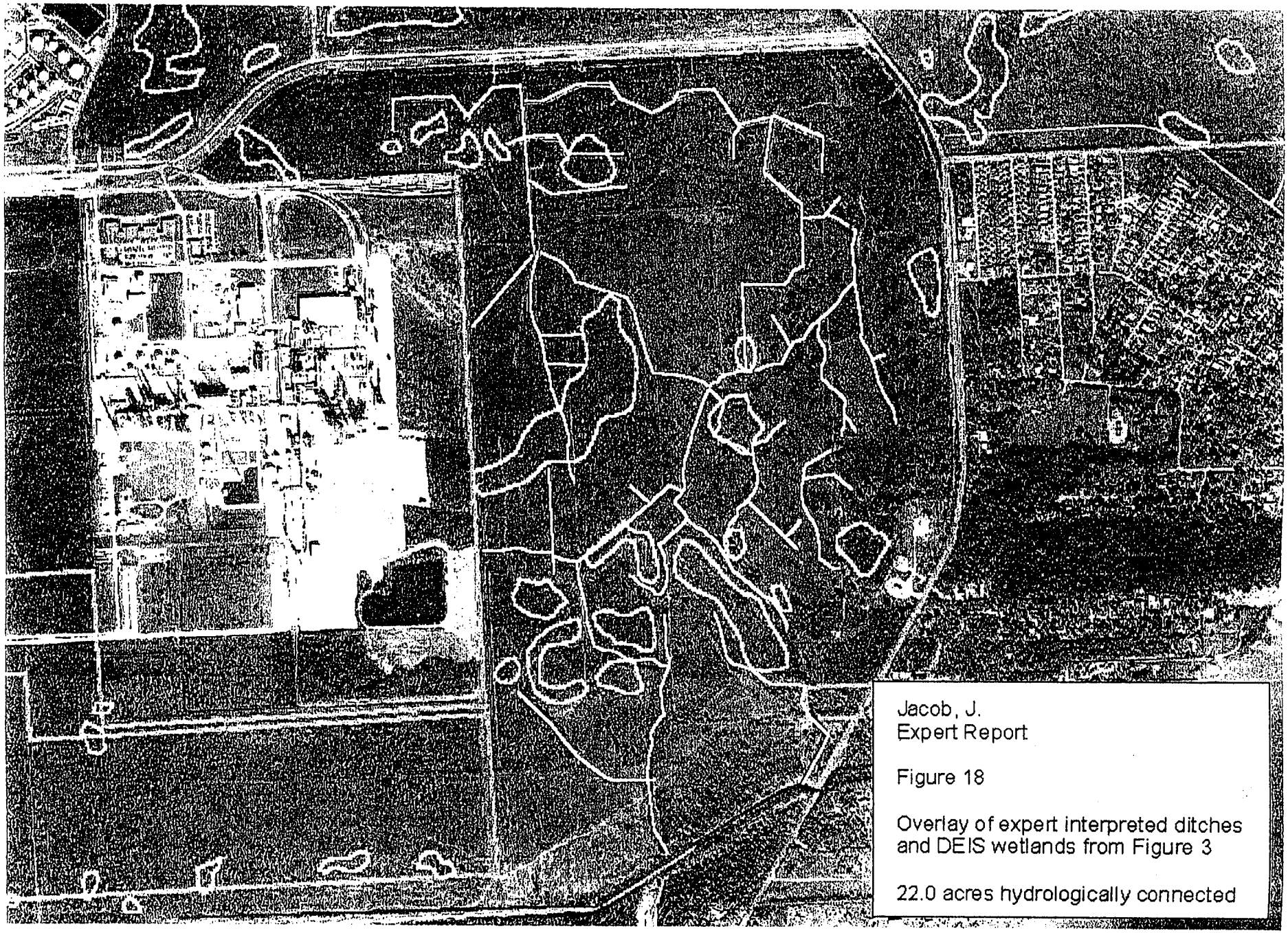
Jacob, J. Expert Report
Figure 17.
Detail from 1995 USGS League City quad showing incorporation of recent drainage into recognized hydrography.
Note direct hydrologic connection with Pine Gully.



Jacob, J. Expert Report
Figure 17A

Detail from 1995 USGS League City quad showing overlay of expert interpretation ditches with USGS hydrography





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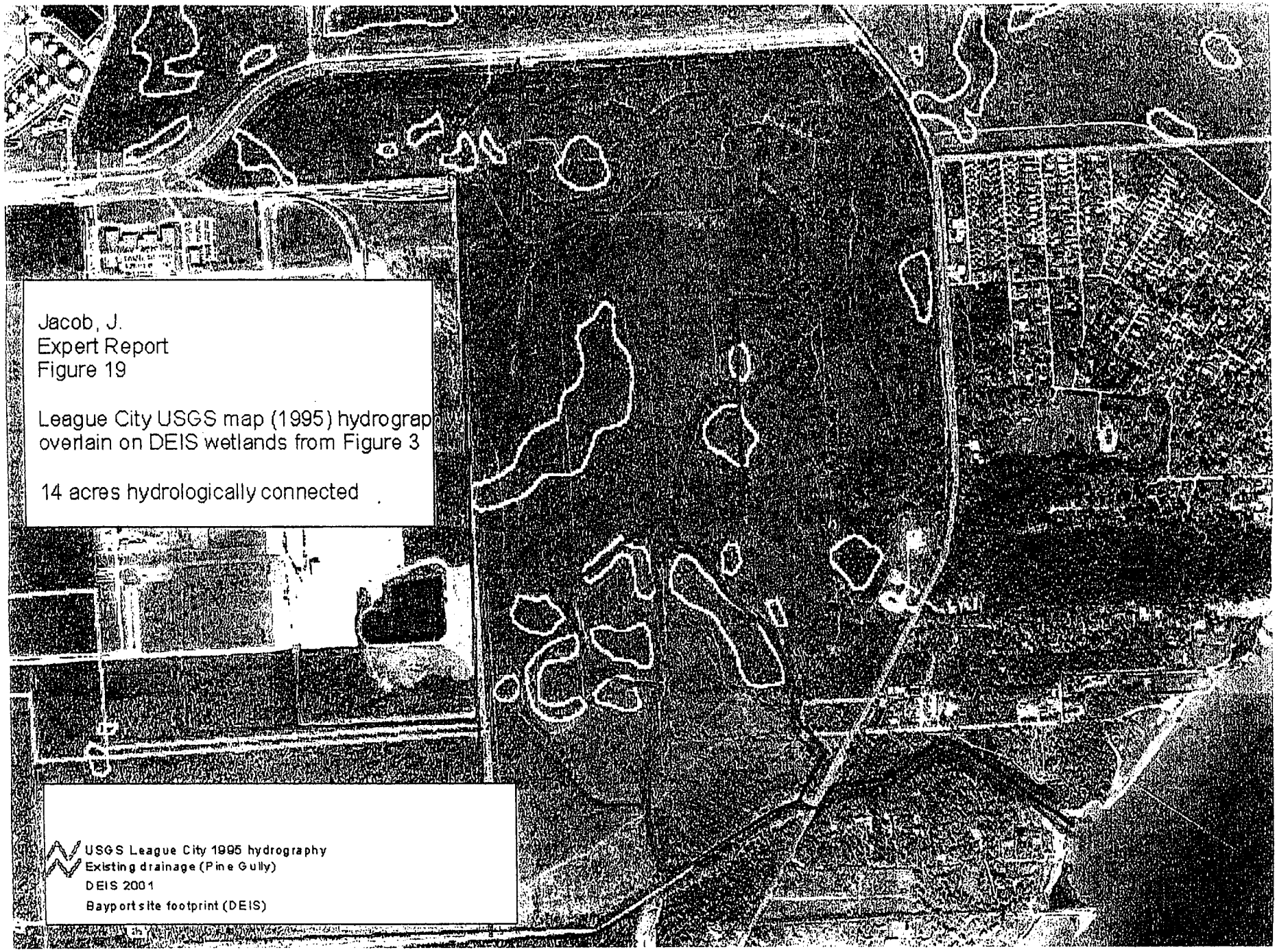
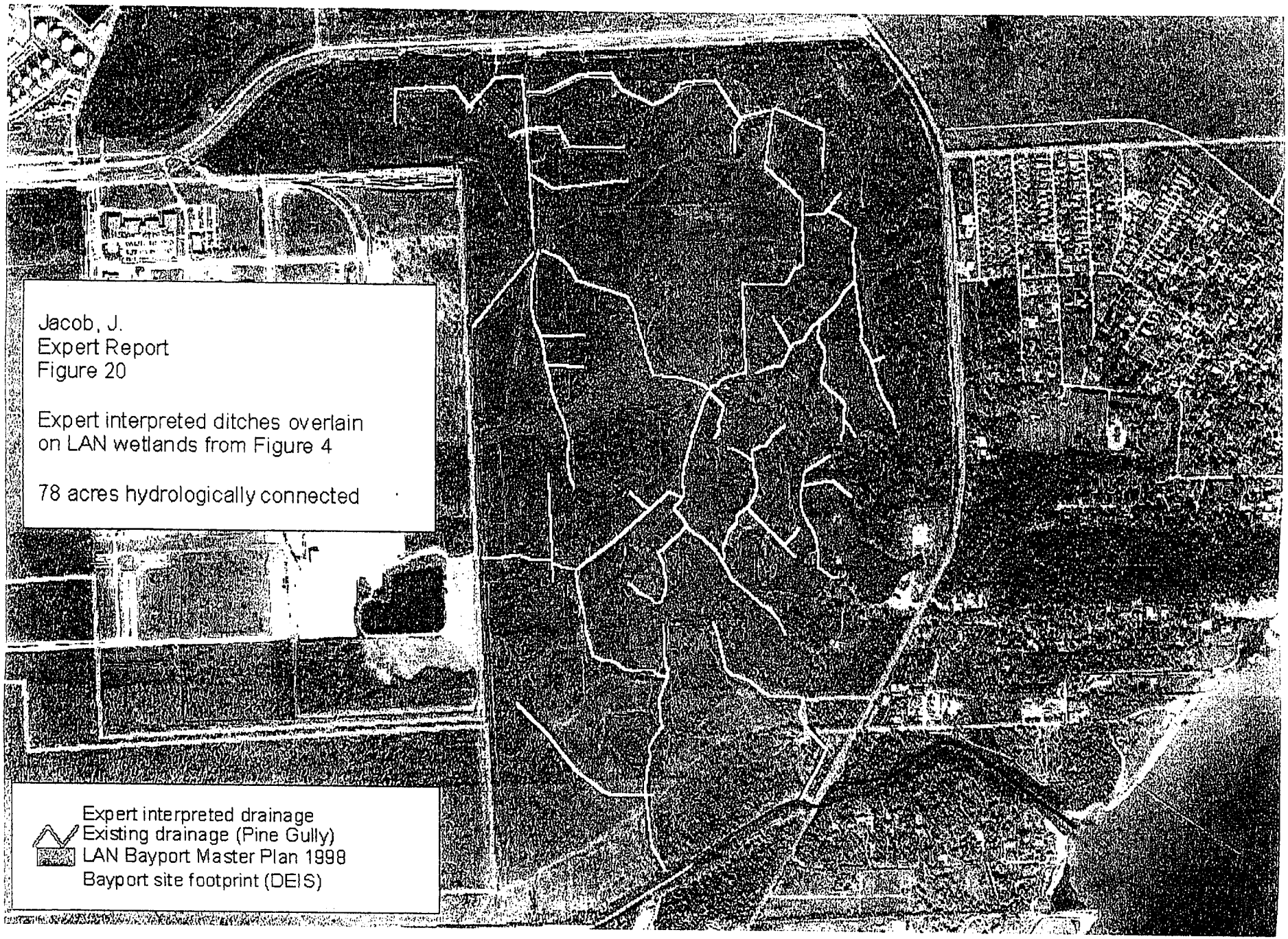
Expert Report

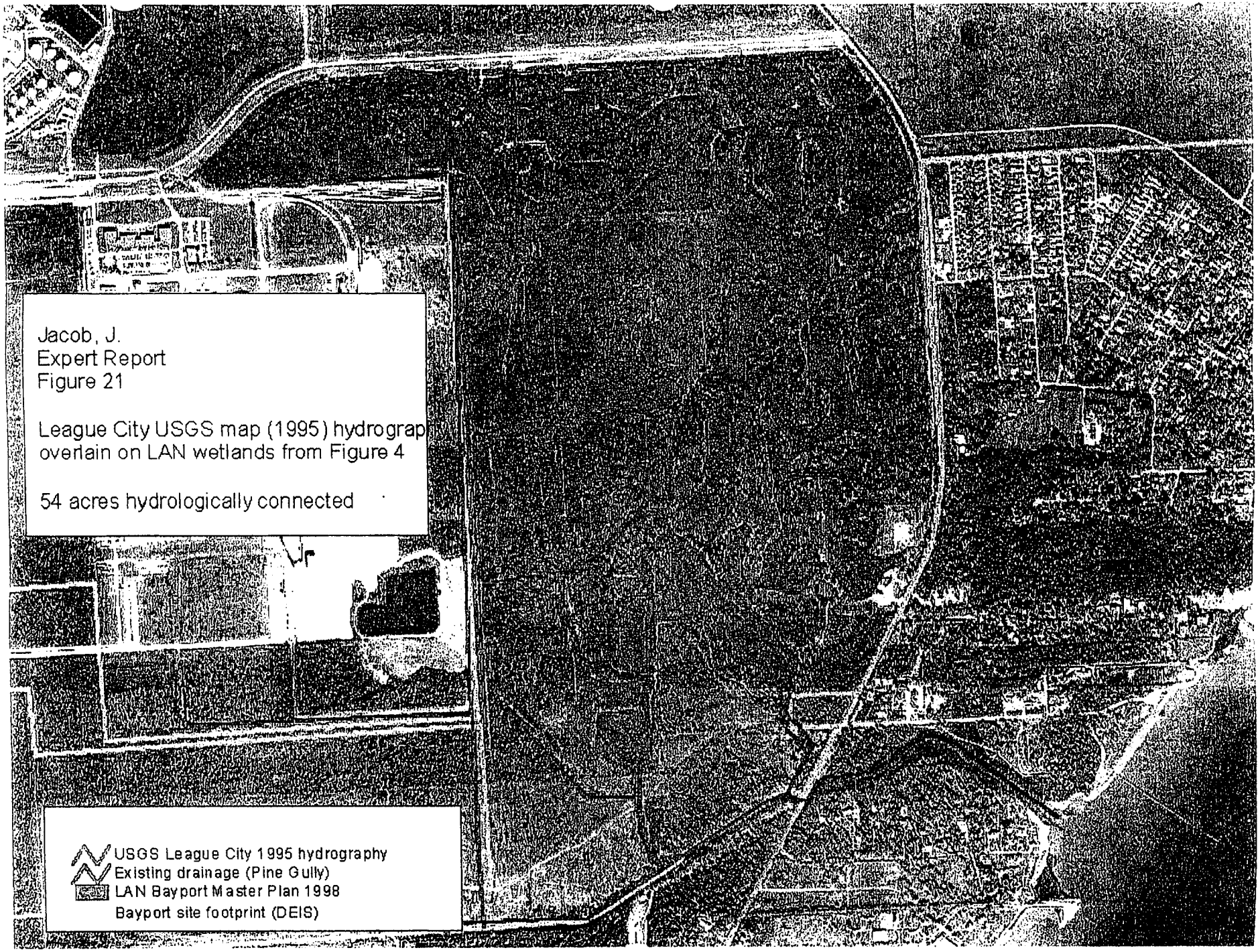
Figure 18

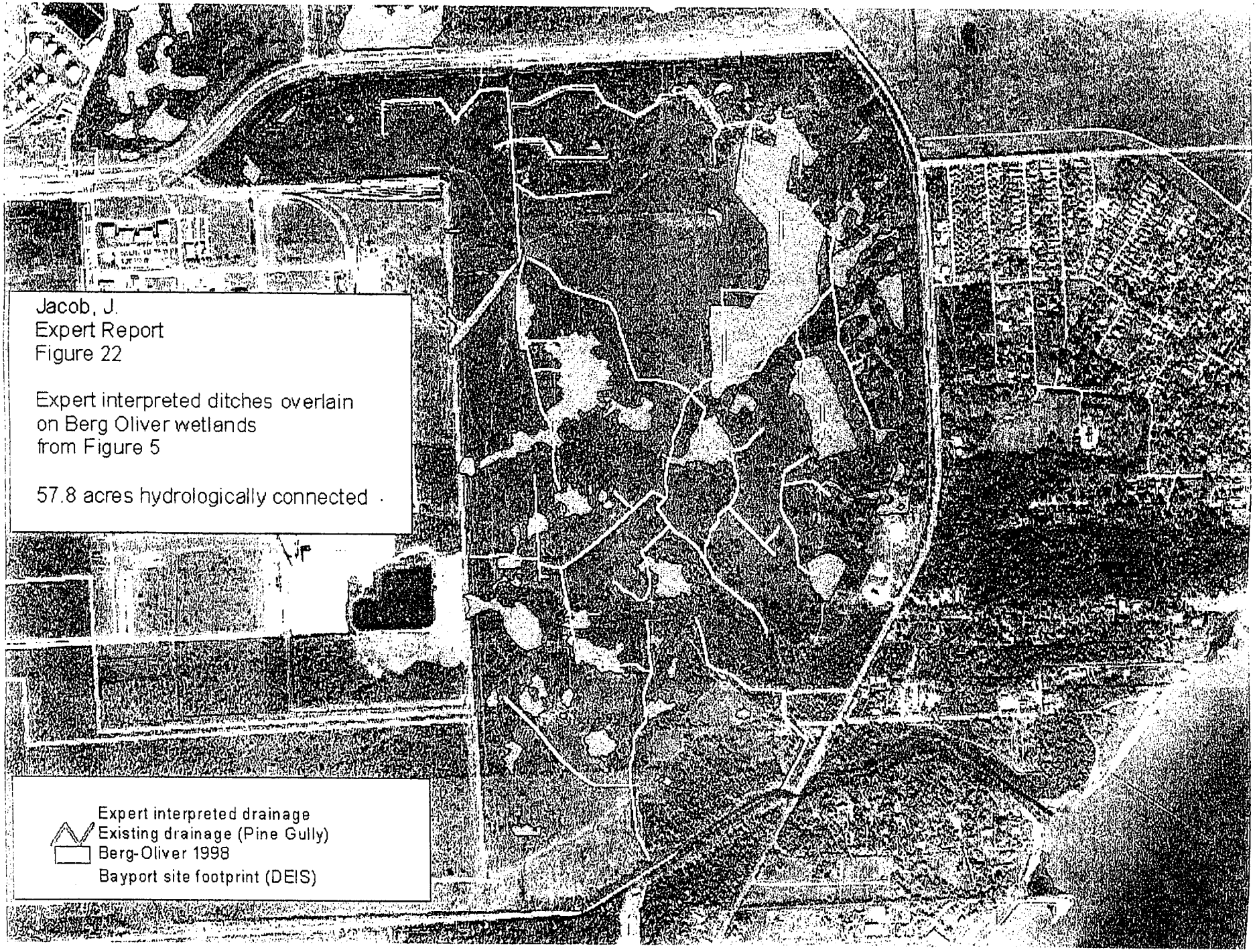
Overlay of expert interpreted ditches and DEIS wetlands from Figure 3

22.0 acres hydrologically connected


Jacob, J.
Expert Report
Figure 19
League City USGS map (1995) hydrograp
overlain on DEIS wetlands from Figure 3
14 acres hydrologically connected
USGS League City 1995 hydrography
Existing drainage (Pine Gully)
DEIS 2001
Bayport site footprint (DEIS)

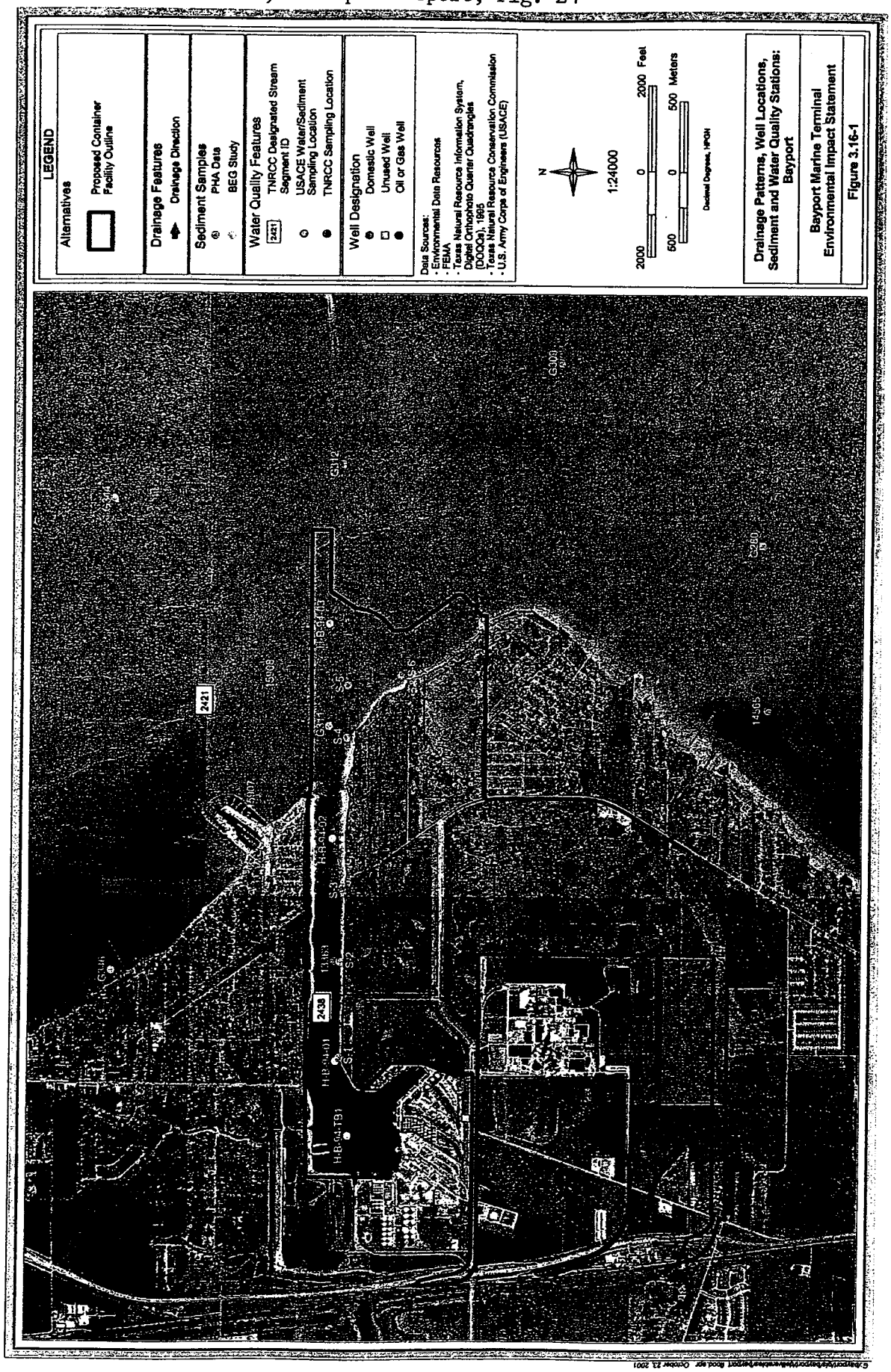

Jacob, J.
Expert Report
Figure 20
Expert interpreted ditches overlain on LAN wetlands from Figure 4
78 acres hydrologically connected
Expert interpreted drainage
Existing drainage (Pine Gully)
LAN Bayport Master Plan 1998
Bayport site footprint (DEIS)


Jacob, J.
Expert Report
Figure 21
League City USGS map (1995) hydrograp
overlain on LAN wetlands from Figure 4
54 acres hydrologically connected
USGS League City 1995 hydrography
Existing drainage (Pine Gully)
LAN Bayport Master Plan 1998
Bayport site footprint (DEIS)


Jacob, J.
Expert Report
Figure 22
Expert interpreted ditches overlain on Berg Oliver wetlands from Figure 5
57.8 acres hydrologically connected
Expert interpreted drainage
Existing drainage (Pine Gully)
Berg-Oliver 1998
Bayport site footprint (DEIS)

Jacob, J.
Expert Report
Figure 23
League City USGS map (1995) hydrography overlain on Berg Oliver wetlands from Figure 5
41.26 acres hydrologically connected.
USGS League City 1995 hydrography
Berg-Oliver 1998
Bayport site footprint (DEIS)

Jacob, J. Expert Report, Fig. 24



Expert Opinion

John S. Jacob, Ph.D.
Professional Wetland Scientist, Certified Professional Soil Scientist

Wetland extent and significance at the proposed
Bayport Channel Container/Cruise Terminal site

January 2002

Appendix 1 – Uniqueness of Wetland Assemblage at Bayport Site

Summary

The Bayport site is covered by a unique prairie-pothole wetland complex that is essentially irreplaceable. This complex is a geological legacy. Furthermore, the coverage of wetlands at this site is not accurately represented in the Draft EIS. Based on the DEIS, it is not possible to make an accurate assessment of the impact of wetland loss at this site, nor can an impartial comparison of the relative impacts be made between the Bayport site and the alternate sites.

A. Features contributing to the significance of the special aquatic sites

The Bayport site (Fig. 1) sits on a remnant meander ridge of the ancient Brazos River (Fig. 2). The deposits of this area were laid down some 30,000 or more years ago (Fisher et al., 1972). The pattern of wetlands on the Bayport site are a product of both the depositional history of the Brazos River in this area and subsequent geomorphic modification of the landscape.

The depressional wetlands, or "potholes" as they are referred to locally on the Gulf Coast, are depressions that were cut by channels of the ancient Brazos river (Bernard, et al., 1970), modified over time by the shifting of the ancient river, much as occurs today on modern floodplains, and subsequently shaped by wind and biotic forces (e.g., buffalo and mammoth). Although greatly modified though geologic time, remnants of channel-like features can still be seen on aerial photographs (Figs. 3a-b).

Interspersed among the potholes are small knolls known regionally as pimple mounds or mima mounds (Fig. 4). These features may be related to modification by wind in a drier epoch of the past (Aronow, 1976). Prairie pothole-pimple mound complexes are thus the product of a combination of geologic and biotic processes that have resulted in a unique and irreplaceable assemblage of wetland and upland habitats. Pothole complexes once covered vast areas of the Gulf Coast, but now occupy only a few fringe sites in the periphery of expanding cites such as Houston. The rest were land-leveled for agriculture or urban development.

The pothole complexes of the Texas Gulf Coast are unique in North America because of the great diversity of hydrologic regimes over very short distances (Moulton and Jacob, 2000). Potholes range from near-permanent saturation to shallower potholes with only a month or two of saturation. Pimple mounds with almost semi-arid hydrology are interspersed in the potholes and on the intermound flats, which also have a diverse range in hydrology depending on their relative elevation. These hydrological niches are closely intermingled in a highly convoluted pattern. The hydrologic pattern translates directly into a similar habitat pattern.

The 1995 color infrared digital ortho-quarter quads (DOQQs) are an excellent basis for examining wetlands. These photos were taken in the late winter/ early spring months. 1995 was a wetter than normal year. At Hobby Airport, the total for 1994 was 58.65 inches and 50.76 inches for 1995. Average rainfall at Hobby is 46.94 inches, so the rainfall during the period the photos were taken is well within one standard deviation of the average (NRCS, 1999). Wet-year photos reveal wetland patterns much better than dry-year photos. The wet-year photographic signatures, however, more closely approximate average-year wetland extent (personal communication, Jim Webb). To evaluate the adequacy of the reported wetlands, I examined the 1995 DOQQ's, as well as additional aerial photos (color 1968, color IR 1989, black and white 1930). I drew a very conservative wetland boundary in this area based on the geological signatures evident on the aerial photographs.

Fig. 9 is a small area of the Bayport site with pronounced wetland features. In general, on this photo the darker the area, the more likely it is a wetland. Fig. 10 is an overlay of my conservative delineation with both the EIS air photo estimate and the LAN report wetlands.

While it would be difficult for any two consultants to independently come up with identical delineations, it is clear from Fig. 10 that some very obvious wetland areas were missed in the LAN report, which was field verified, and much more so for those described in the DEIS, which was not field verified. Of particular concern, the DEIS ostensibly used this exact same method of photographic interpretation to arrive at its total wetland and special aquatic site figure.

The pattern at the Bayport site is indeed very complex, and there are many areas where a distinct wetland boundary is difficult to find. But here we have some very obvious wetland areas that were missed. A project of this magnitude on a site of this quality demands an accurate accounting of the wetland resources. It is clear that the consultants associated with both the DEIS and the LAN report sought to report the smallest amount of wetlands possible.

There is some indication that wetland delineations throughout the Galveston district may be somewhat less than thorough (Jacob, 1999). Student work done at the University of Houston – Clear Lake (documentation in possession of author) demonstrated that "tight" delineations are not at all uncommon in this area

Figures

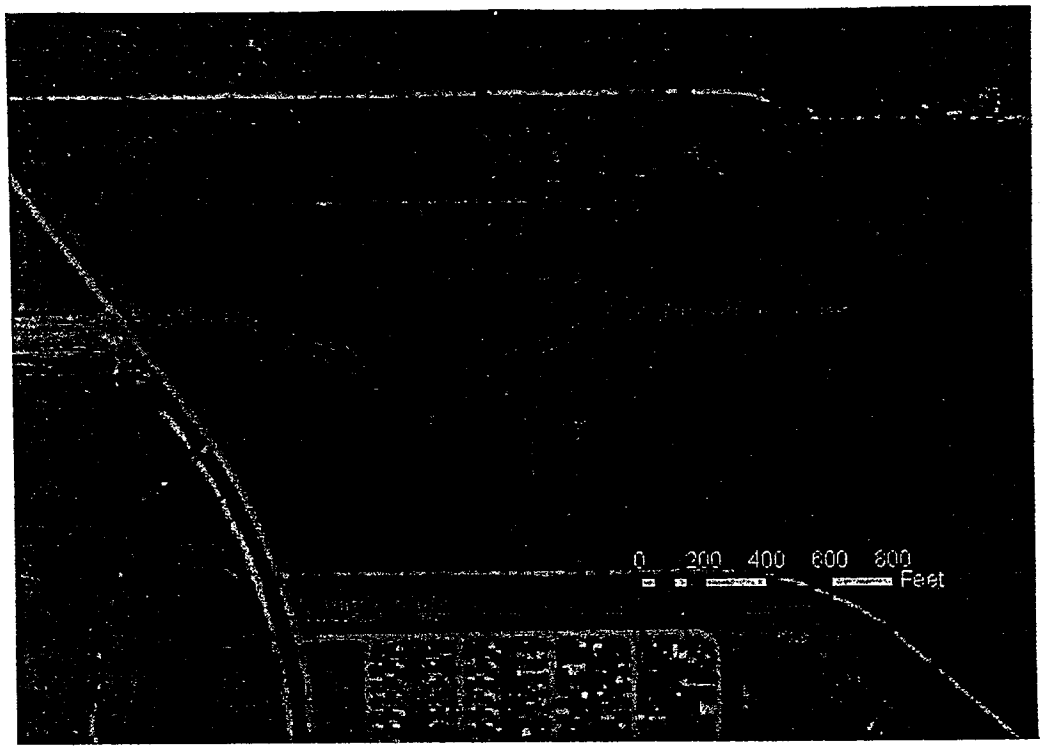


Figure 3a. Aerial photo (1995 DOQQ) of a portion of the Bayport site.

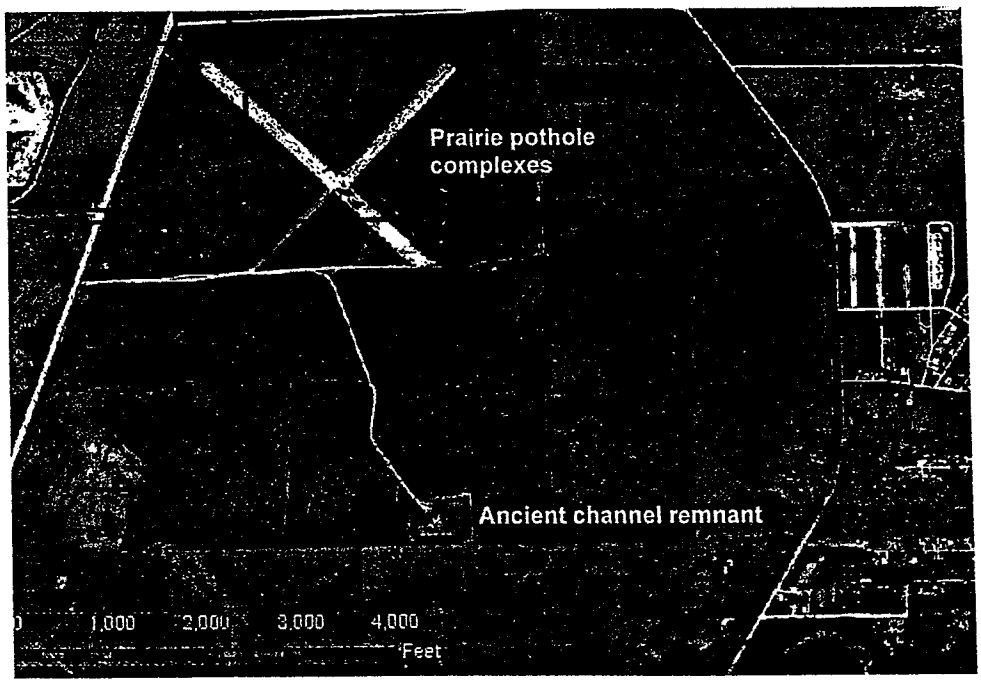


Figure 3b. Aerial photo (1968 color) of a portion of the Bayport site.

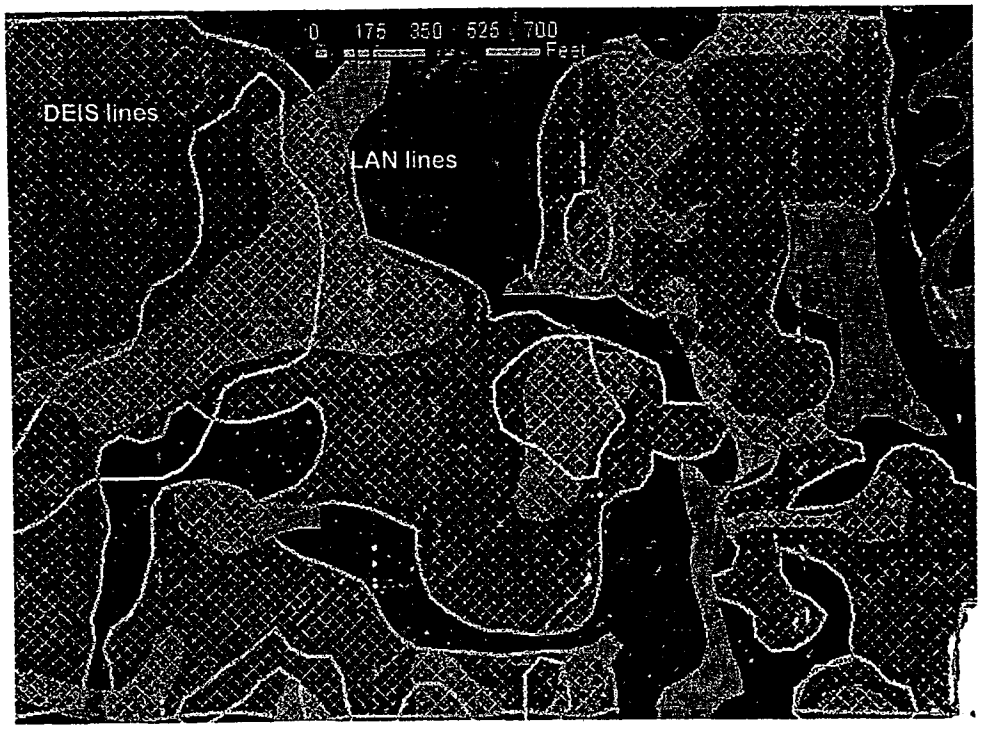


Figure 10. Same area as Fig. 9. Cross hatched areas are a conservative estimate of wetlands based on interpretation of air photo geologic signatures.

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Fisher, W.L., McGowen, J.H., Brown, L.F., and Groat, C.G. 1972. Environmental Geologic Atlas of the Texas coastal zone – Galveston-Houston area. University of Texas Bureau of Economic Geology. Austin.

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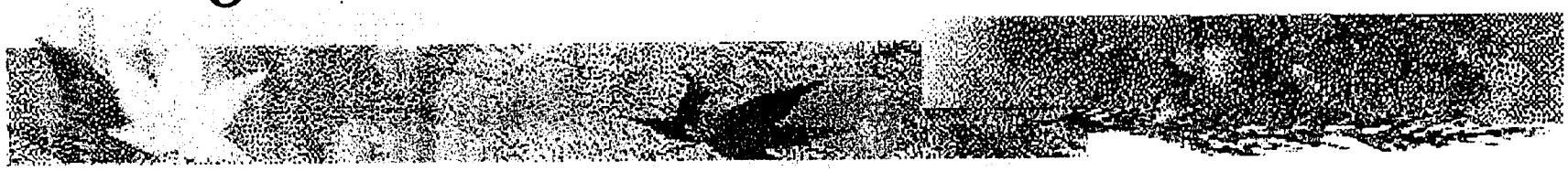
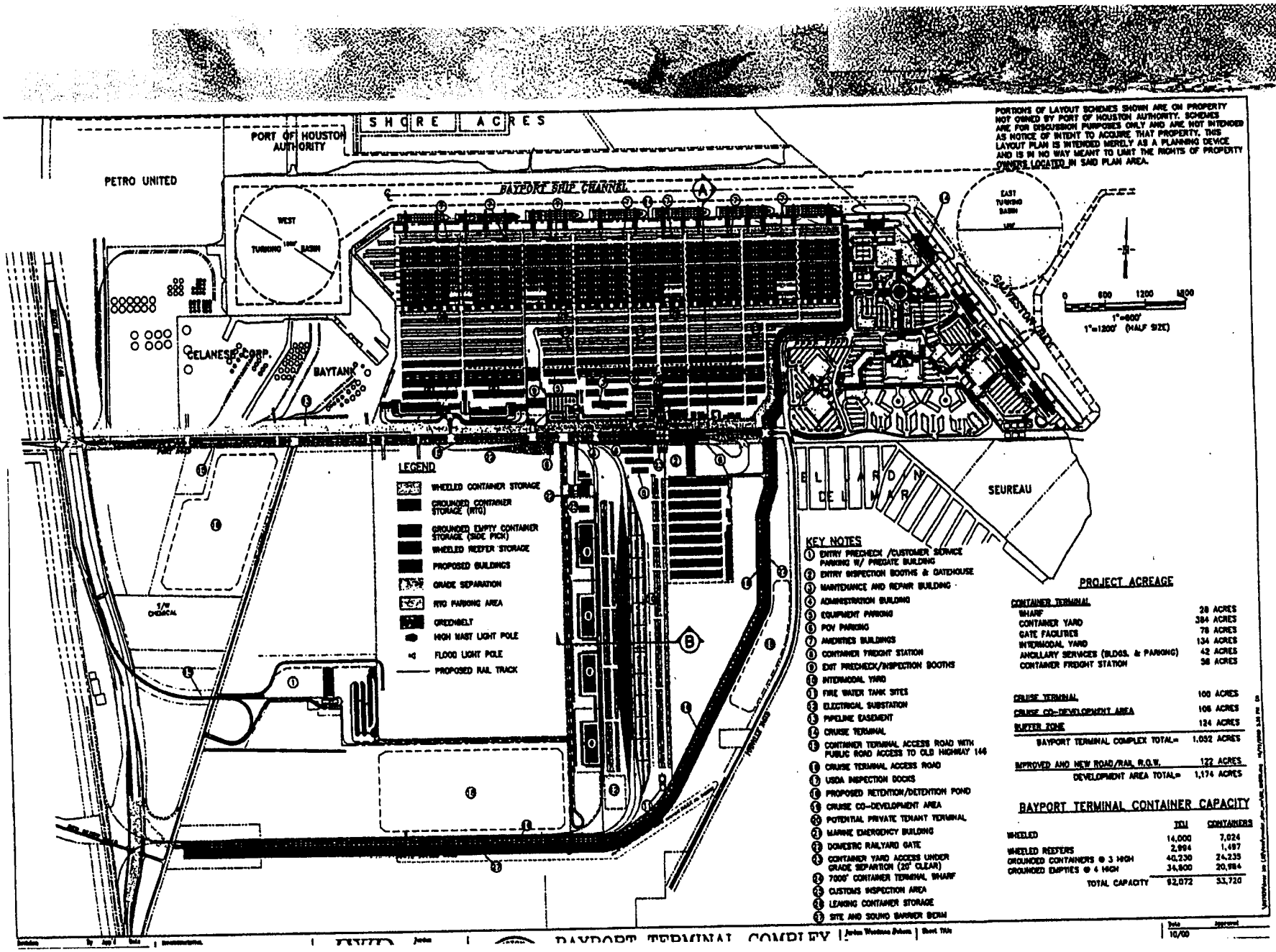
Lockwood, Andrews, and Newnam, Inc. 1998. Technical Memorandum 5: Wetlands, Jurisdictional Waters, and Bay and Estuary Resources, Bayport Terminal Complex, Environmental Issues and Inventory, Volume 7 of 8 of the Bayport Master Plan.

Jurisdictional Issues for Bayport Site Pertaining to §401 and §404 Review



(37 slides)


PORTIONS OF LAYOUT SCHEMES SHOWN ARE ON PROPERTY NOT OWNED BY PORT OF HOUSTON AUTHORITY. SCHEMES ARE FOR DISCUSSION PURPOSES ONLY AND ARE NOT INTENDED AS NOTICE OF INTENT TO ACQUIRE THAT PROPERTY. THIS LAYOUT PLAN IS INTENDED MERELY AS A PLANNING DEVICE AND IS IN NO WAY MEANT TO LIMIT THE RIGHTS OF PROPERTY OWNERS LOCATED IN SAID PLAN AREA.
SHORE ACRES
PORT OF HOUSTON AUTHORITY
PETRO UNITED
BAYPORT SHIP CHANNEL
WEST TURNING BASIN
EAST TURNING BASIN
CELANESE CORP.
BAYTANK
GALVESTON BAY
EL JARDIN DE MAR
SEUREAU
0 600 1200 1800
1"=600'
1"=1200' (HALF SIZE)
LEGEND
WHEELED CONTAINER STORAGE
GROUNDED CONTAINER STORAGE (RTG)
GROUNDED EMPTY CONTAINER STORAGE (SIDE PICK)
WHEELED REEFER STORAGE
PROPOSED BUILDINGS
GRADE SEPARATION
RTG PARKING AREA
GREENBELT
HIGH MAST LIGHT POLE
FLOOD LIGHT POLE
PROPOSED RAIL TRACK
KEY NOTES
1 ENTRY PRECHECK /CUSTOMER SERVICE PARKING W/ PREGATE BUILDING
2 ENTRY INSPECTION BOOTHS & GATEHOUSE
3 MAINTENANCE AND REPAIR BUILDING
4 ADMINISTRATION BUILDING
5 EQUIPMENT PARKING
6 POV PARKING
7 AMENITIES BUILDINGS
8 CONTAINER FREIGHT STATION
9 EXIT PRECHECK/INSPECTION BOOTHS
10 INTERMODAL YARD
11 FIRE WATER TANK SITES
12 ELECTRICAL SUBSTATION
13 PIPELINE EASEMENT
14 CRUISE TERMINAL
15 CONTAINER TERMINAL ACCESS ROAD WITH PUBLIC ROAD ACCESS TO OLD HIGHWAY 146
16 CRUISE TERMINAL ACCESS ROAD
17 USDA INSPECTION DOCKS
18 PROPOSED RETENTION/DETENTION POND
19 CRUISE CO-DEVELOPMENT AREA
20 POTENTIAL PRIVATE TENANT TERMINAL
21 MARINE EMERGENCY BUILDING
22 DOMESTIC RAILYARD GATE
23 CONTAINER YARD ACCESS UNDER GRADE SEPARTION (20' CLEAR)
24 7000' CONTAINER TERMINAL WHARF
25 CUSTOMS INSPECTION AREA
26 LEAKING CONTAINER STORAGE
27 SITE AND SOUND BARRIER BERM
PROJECT ACREAGE
CONTAINER TERMINAL
WHARF 28 ACRES
CONTAINER YARD 384 ACRES
GATE FACILITIES 78 ACRES
INTERMODAL YARD 134 ACRES
ANCILLARY SERVICES (BLDGS. & PARKING) 42 ACRES
CONTAINER FREIGHT STATION 58 ACRES
CRUISE TERMINAL 100 ACRES
CRUISE CO-DEVELOPMENT AREA 106 ACRES
BUFFER ZONE 124 ACRES
BAYPORT TERMINAL COMPLEX TOTAL= 1,052 ACRES
IMPROVED AND NEW ROAD/RAIL R.O.W. 122 ACRES
DEVELOPMENT AREA TOTAL= 1,174 ACRES
BAYPORT TERMINAL CONTAINER CAPACITY
TEU CONTAINERS
WHEELED 14,000 7,024
WHEELED REEFERS 2,994 1,497
GROUNDED CONTAINERS @ 3 HIGH 40,230 24,235
GROUNDED EMPTIES @ 4 HIGH 34,800 20,984
TOTAL CAPACITY 92,072 53,720
10/00

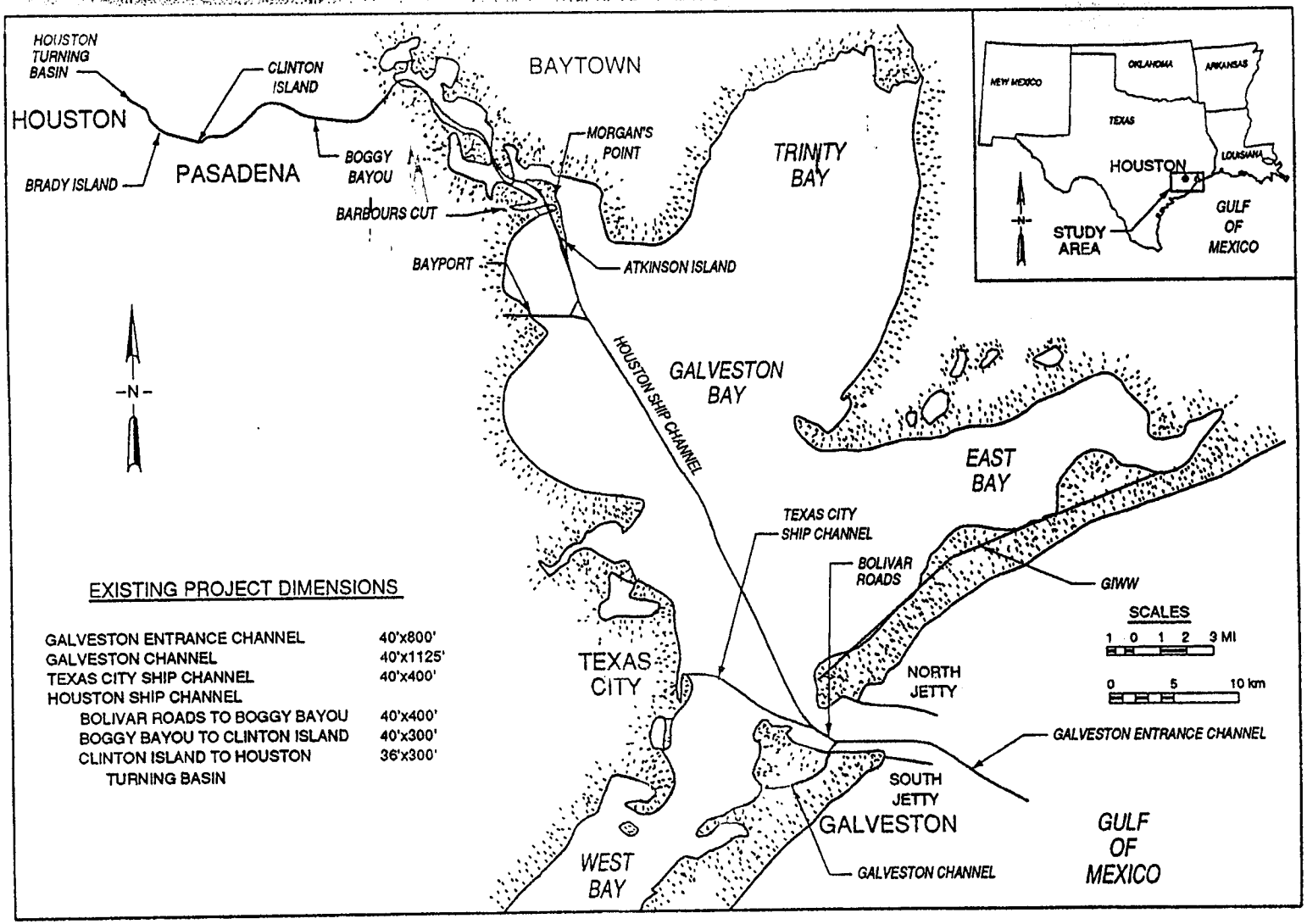


Figure 1. Location map of Houston-Galveston Navigation Channel Project

Overview

I. Background on type and significance of wetlands

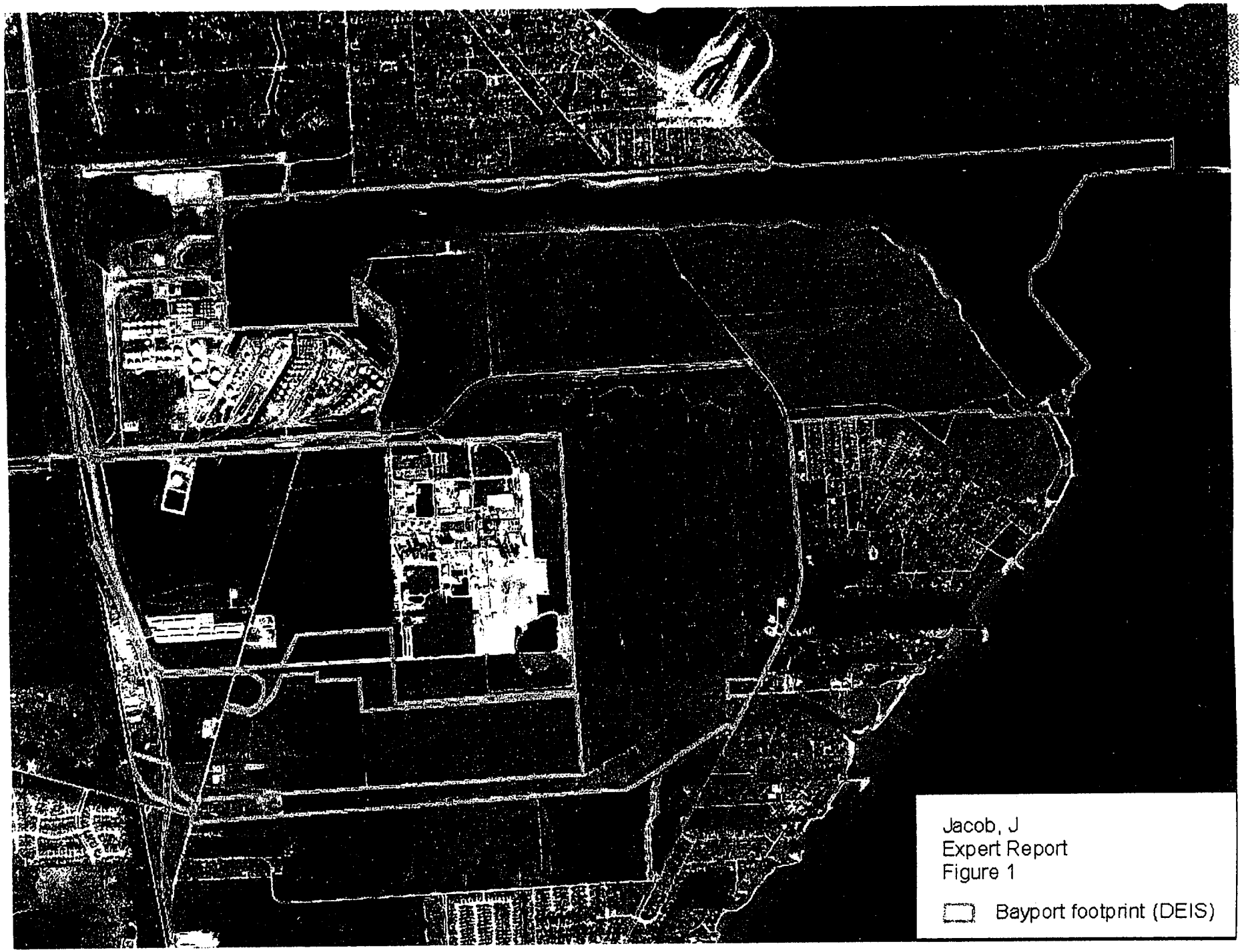
II. Delineation of 100+ acres of wetlands

III. Problem - "jurisdictional" wetlands

1. Corps of Engineers - 2.5 acres
2. GBCPA – 50-100+ acres

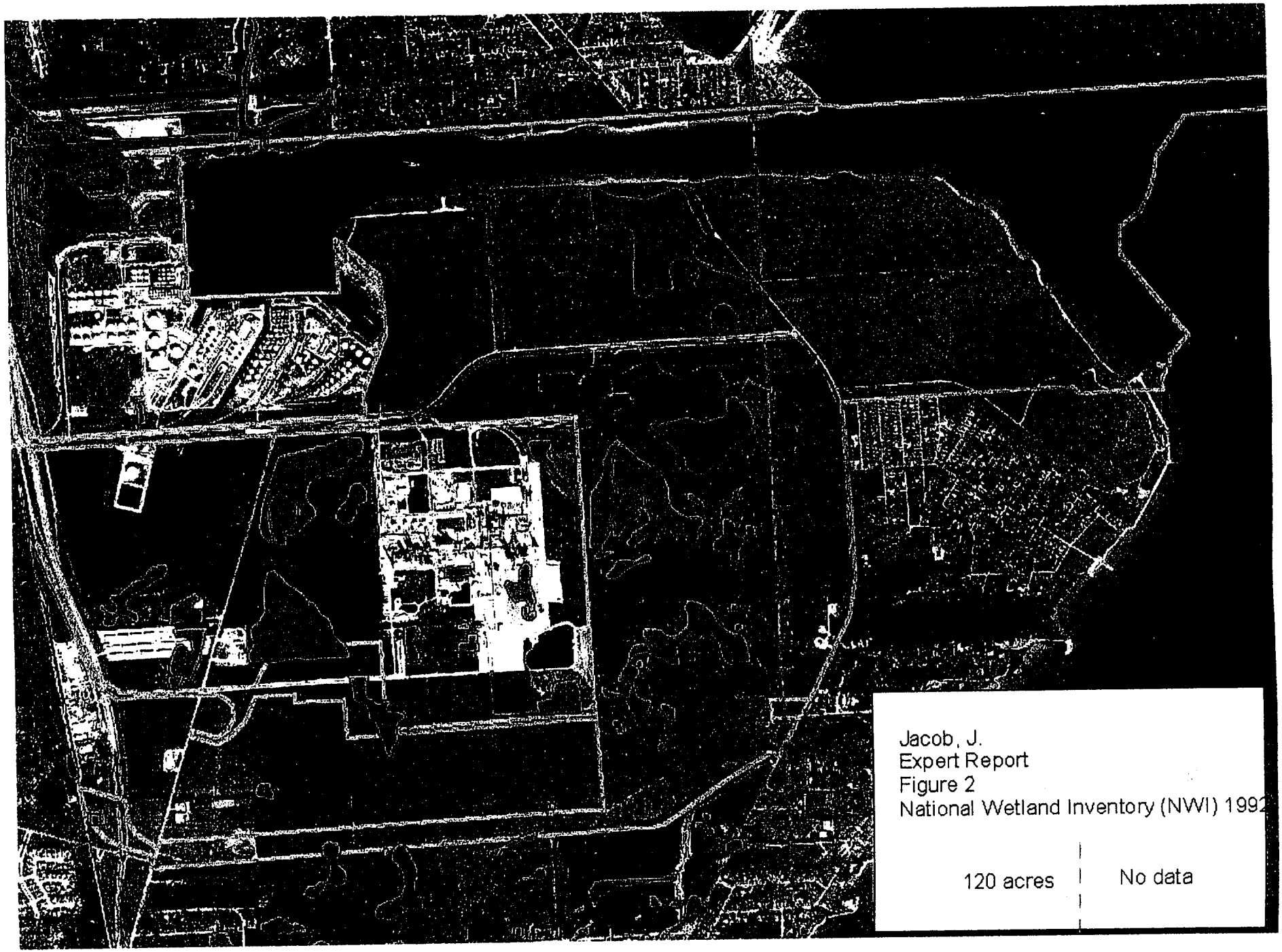
IV. Dispute - "Adjacent" v. "Isolated"

V. Proof of "adjacency" - hydrologic connection



Jacob, J
Expert Report
Figure 1

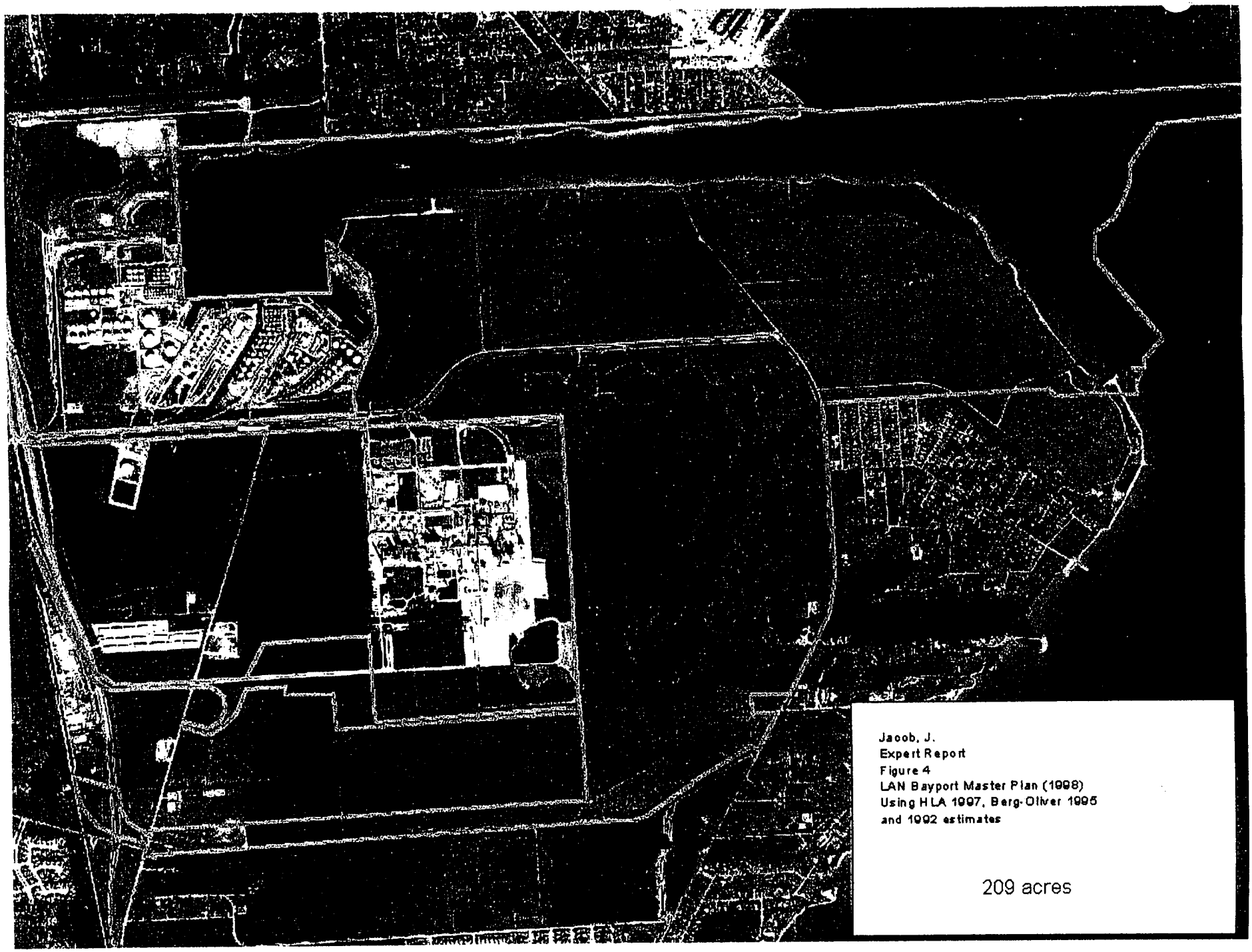
Bayport footprint (DEIS)



Jacob, J.
Expert Report
Figure 2
National Wetland Inventory (NWI) 1992

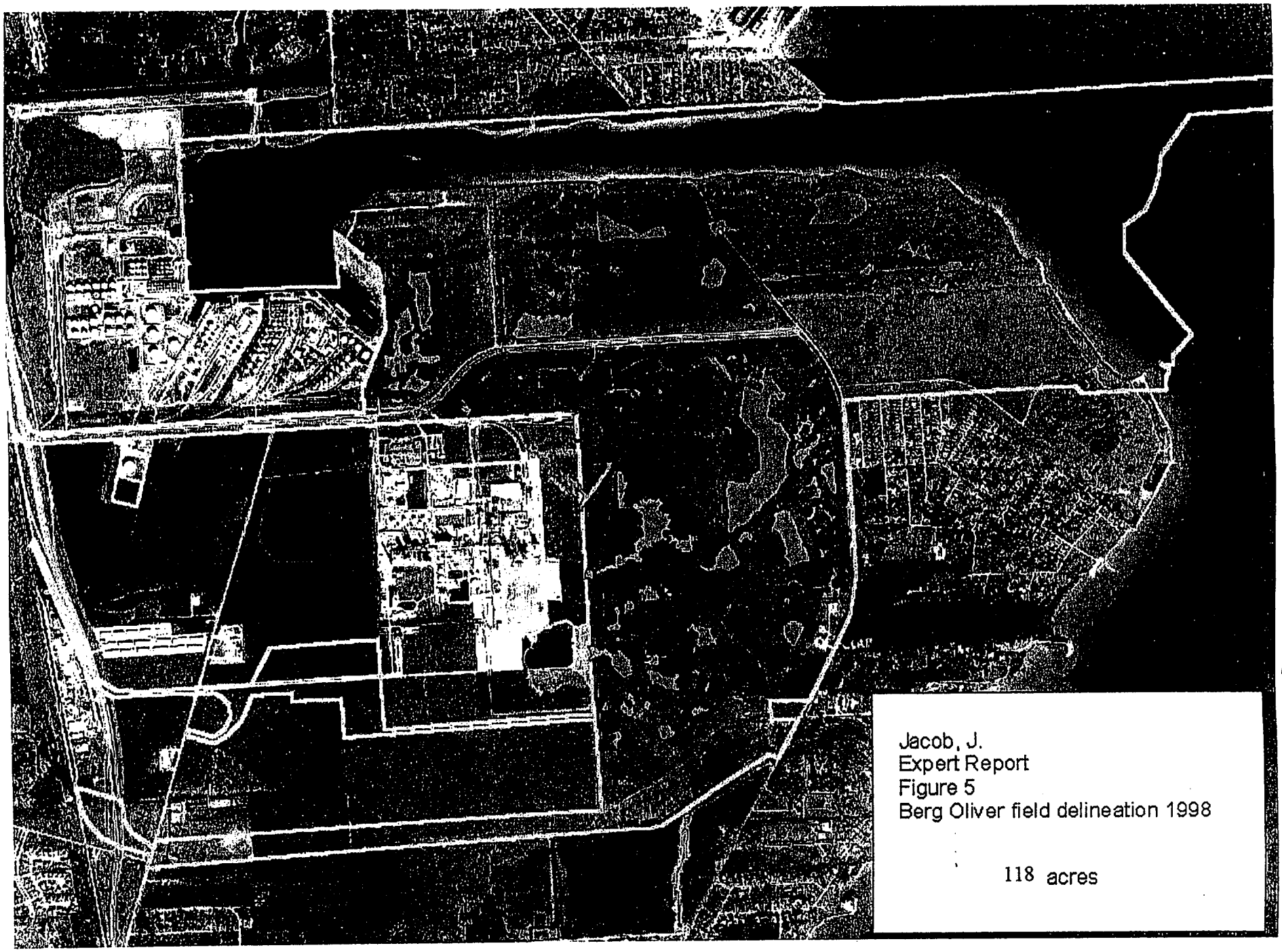
Jacob, J.
Expert Report
Figure 3
DEIS Wetlands as shown in
DEIS Fig 3.19--7

106 acres



Jacob, J.
Expert Report
Figure 4
LAN Bayport Master Plan (1998)
Using HLA 1997, Berg-Oliver 1995
and 1992 estimates

209 acres



Jacob, J.
Expert Report
Figure 5
Berg Oliver field delineation 1998

118 acres

Jacob, J.
Expert Report
Figure 6
Overlay of Figures 1 - 5

Galveston District Policy Statement in DEIS

"The USACE [Galveston] has recently attempted to clarify this definition in light of the recent Supreme Court ruling using the following criteria:

•**Hydrologic Connections**: Relationships between navigable water, or a surface tributary system, must exist to be considered adjacent. *Otherwise, the wetland is considered isolated.* Examples of hydrologic connections include surface tributary systems, surface water connections such as a stream, continuous wetland system, ditch, or other watercourse that carries water from a water body to navigable waters, or waters that are part of a surface tributary system, during normal expected flows or predictable flood events.

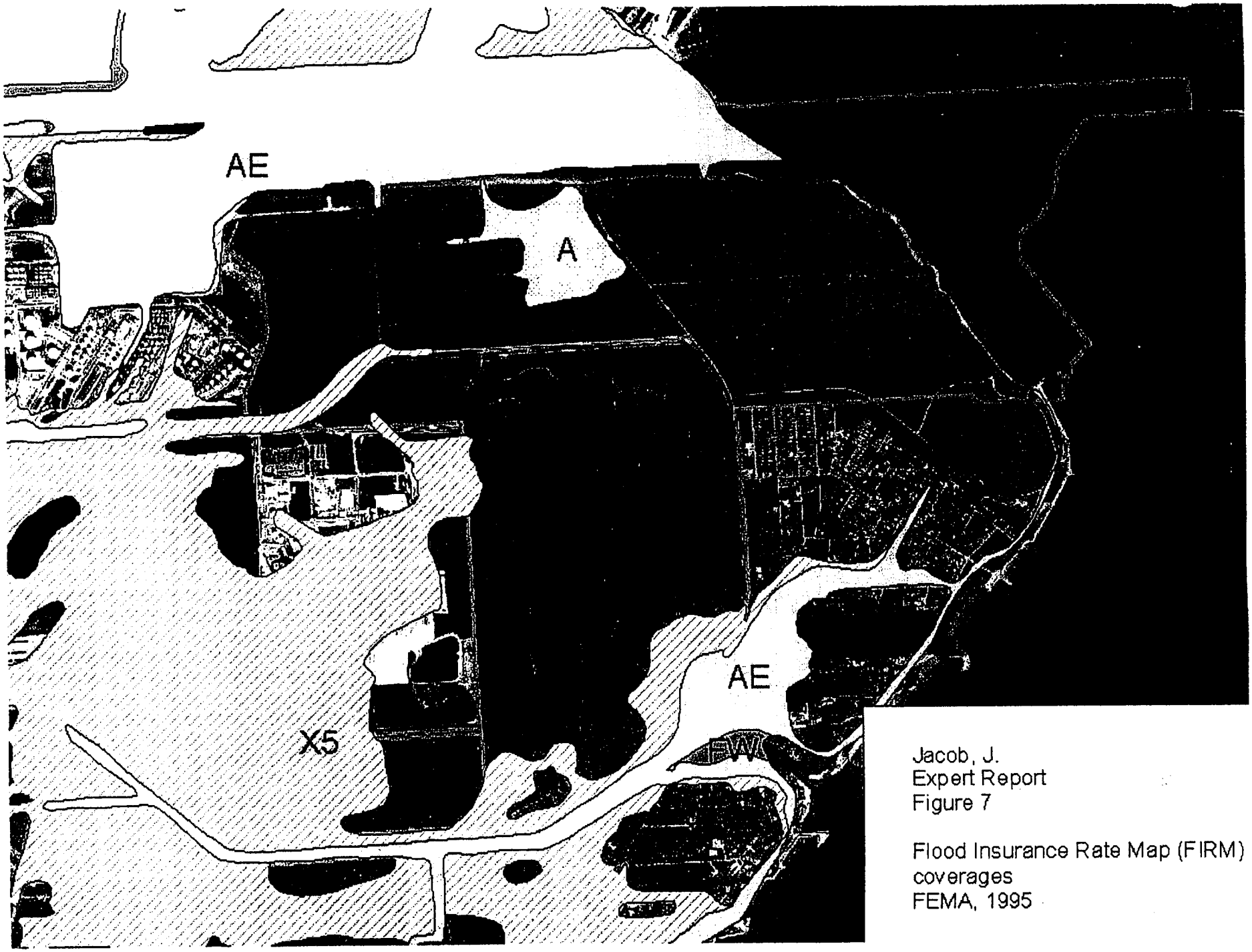
- DEIS, pp. 3.19-2 to 3.19-3

Galveston District Policy Statement in DEIS

•**<u>100-year Floodplain</u>**: It is reasonable to consider wetlands that lie within the 100-year floodplain as adjacent. However, it should be noted that sheet flow over land, outside a floodplain is not considered a sufficient hydrologic connection.

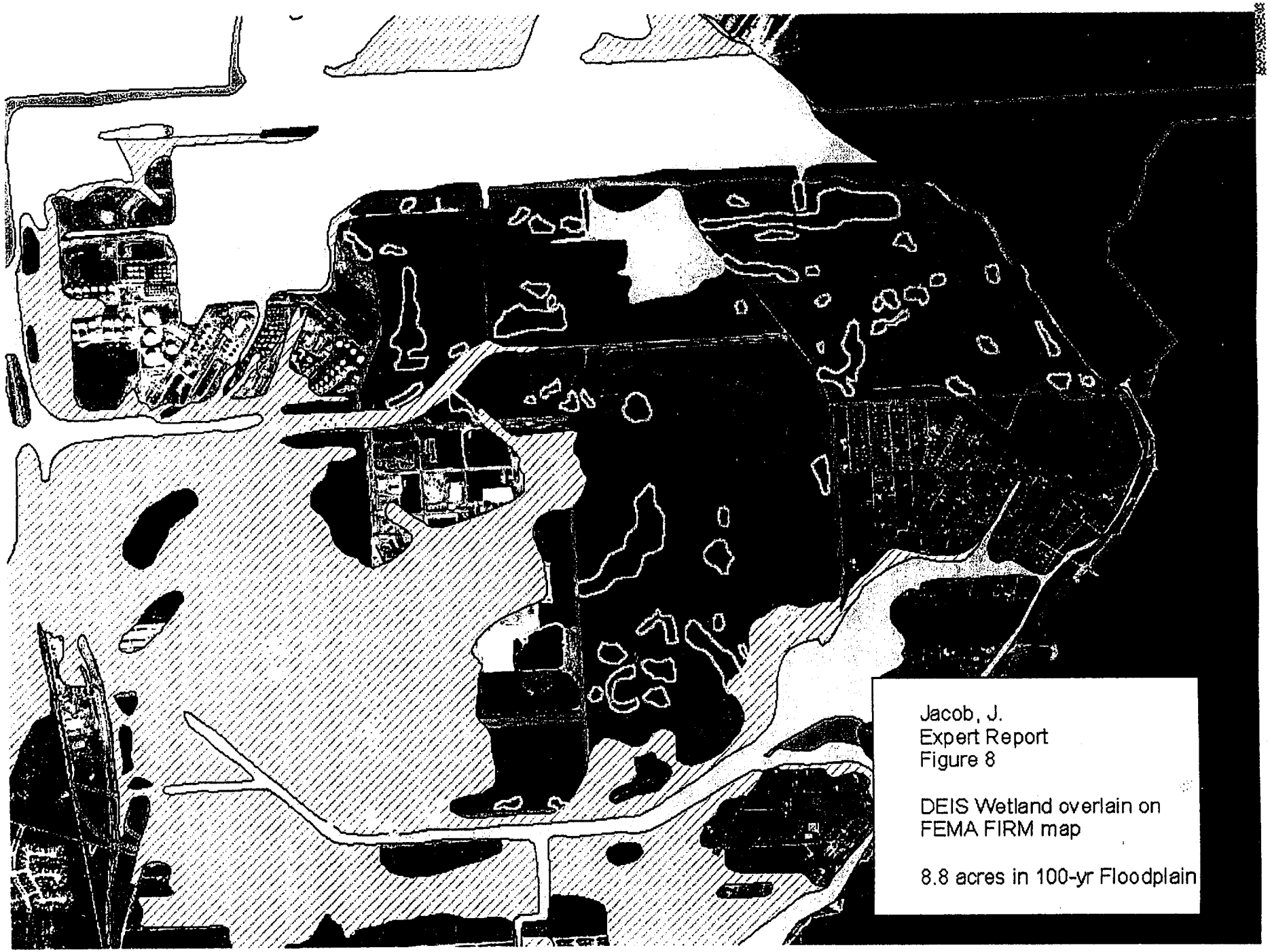
Many of the wetlands in the Galveston Bay region are isolated and would not fall under the jurisdiction of requiring a permit before impact may occur.

- DEIS, p. 3.19-3



Jacob, J.
Expert Report
Figure 7

Flood Insurance Rate Map (FIRM) coverages
FEMA, 1995



Jacob, J.
Expert Report
Figure 8

DEIS Wetland overlain on
FEMA FIRM map

8.8 acres in 100-yr Floodplain

Jacob, J.
Expert Report
Figure 9

LAN Bayport Master Plan (1998)
overlain on FEMA FIRM map

22.0 acres in 100-yr Floodplain

Jacob, J.
Expert Report
Figure 10

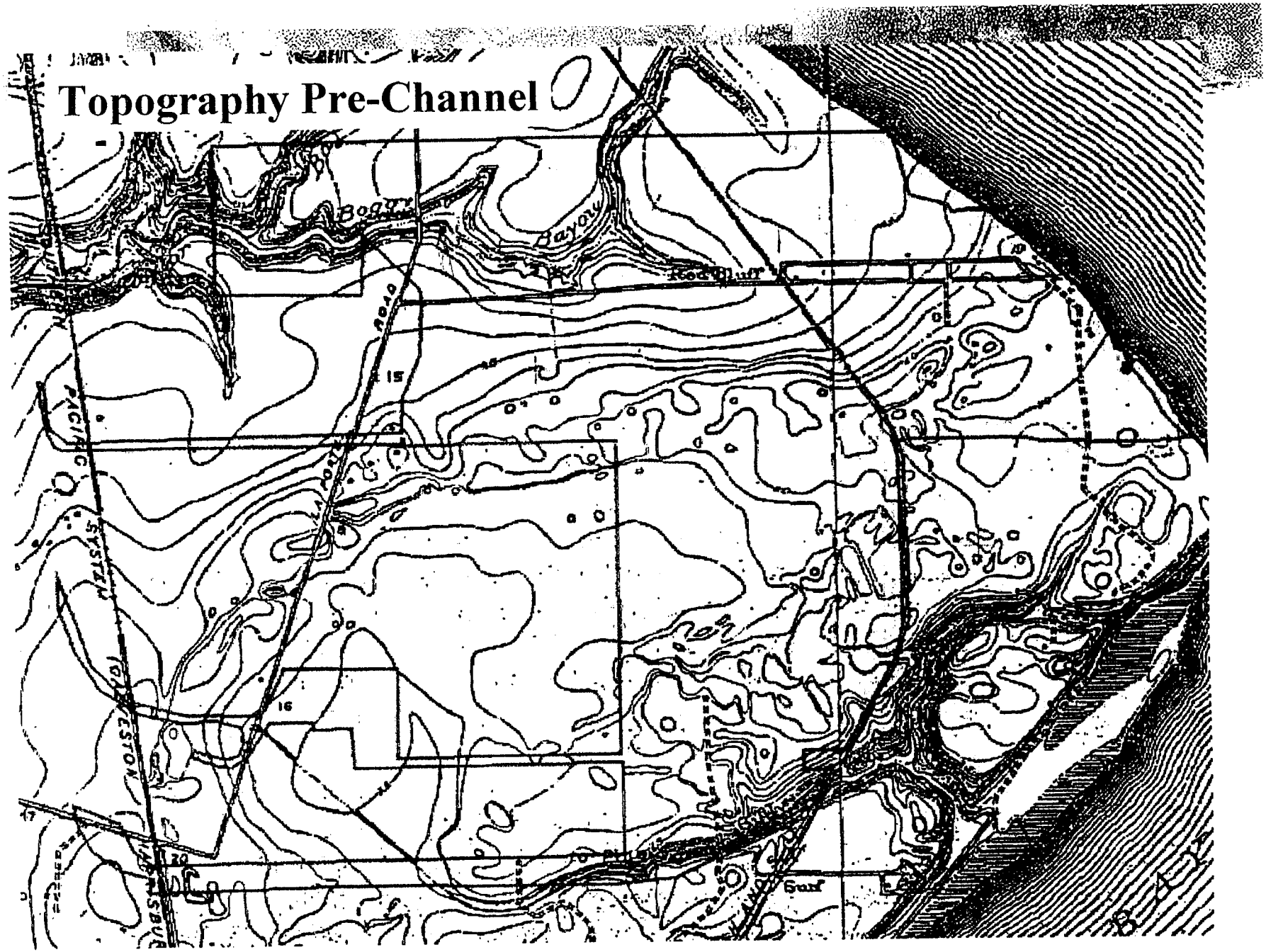
Berg Oliver field delineation (1998) overlain on FEMA FIRM map

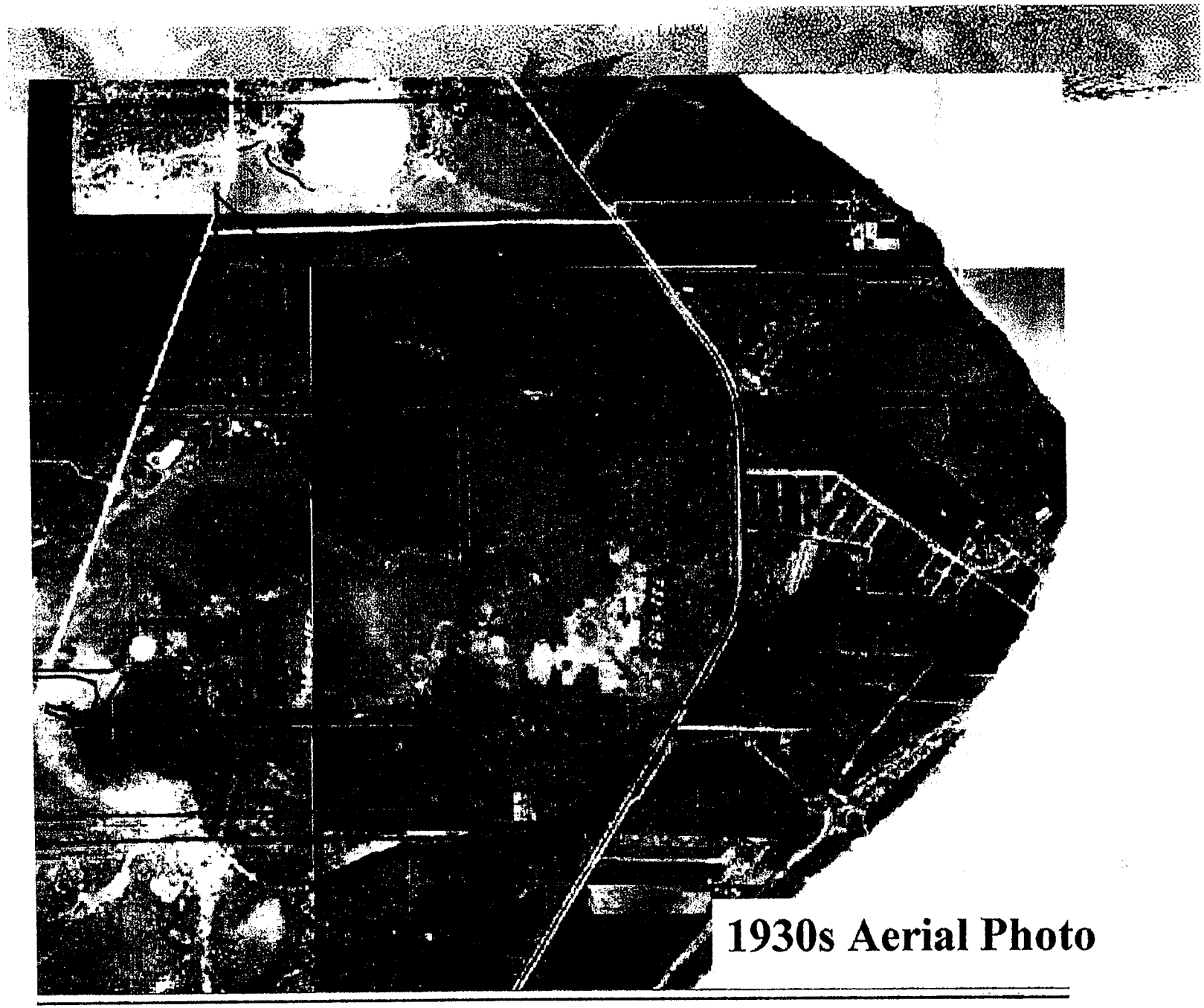
5.52 acres in 100-yr floodplain

Proof of "Adjacency" - Hydrologic Connection

- Surface tributary systems
- Surface water connections
  - **Stream**
  - **Continuous wetlands**
  - **Ditch or other watercourse**
- Waters part of a surface tributary system during normal flows or predictable flood events

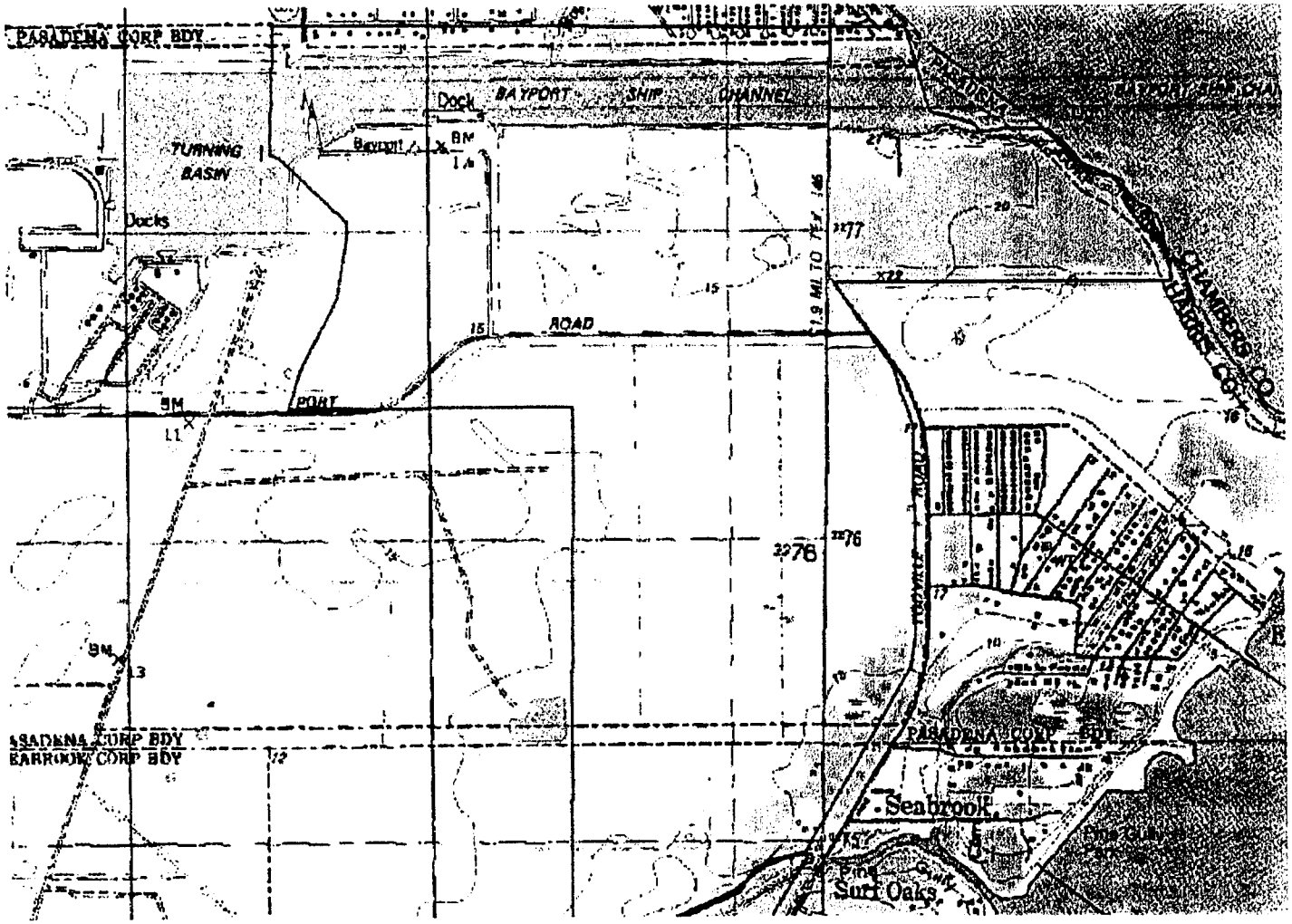
Topography Pre-Channel





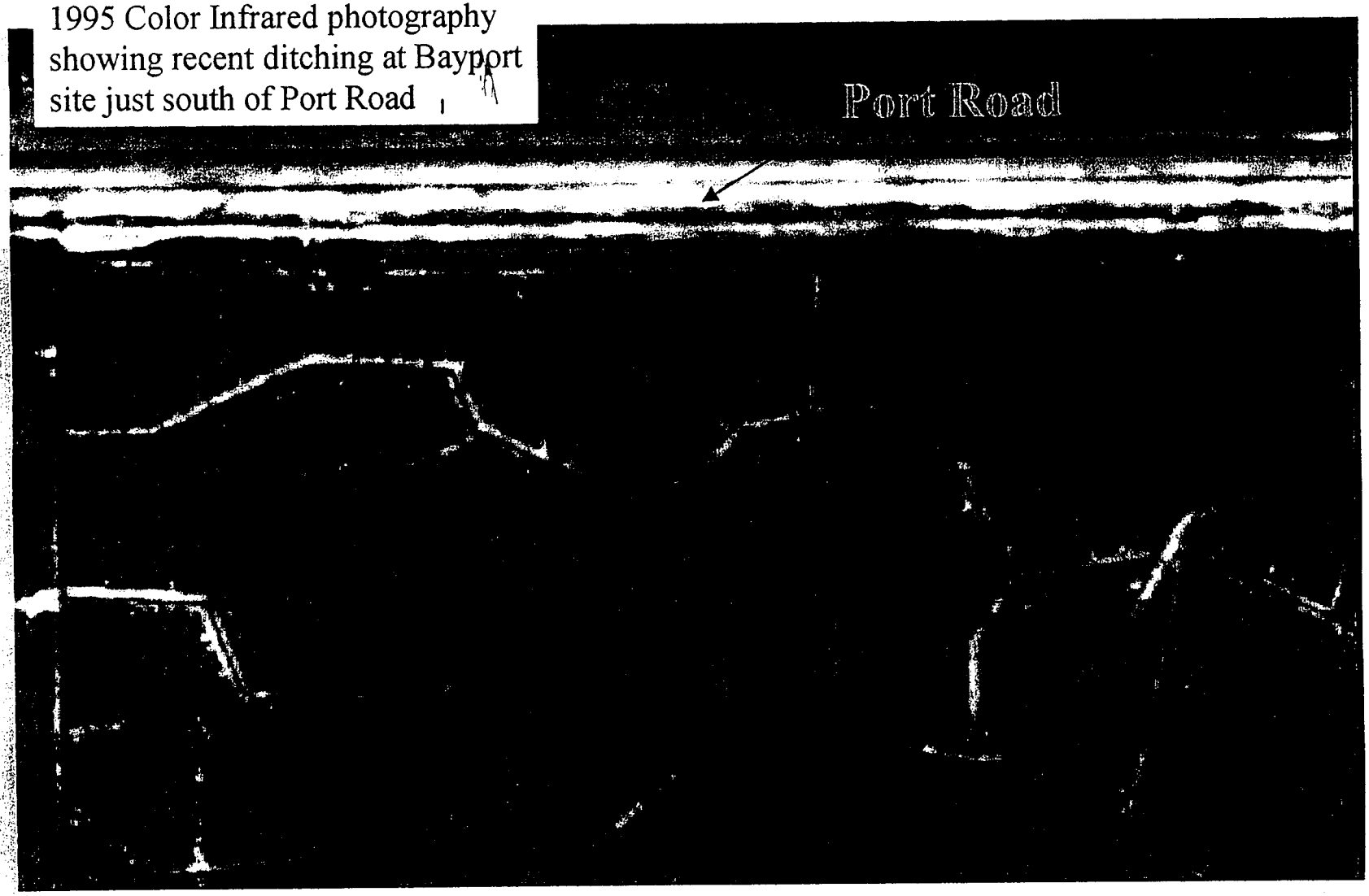
1930s Aerial Photo

1983 League City USGS



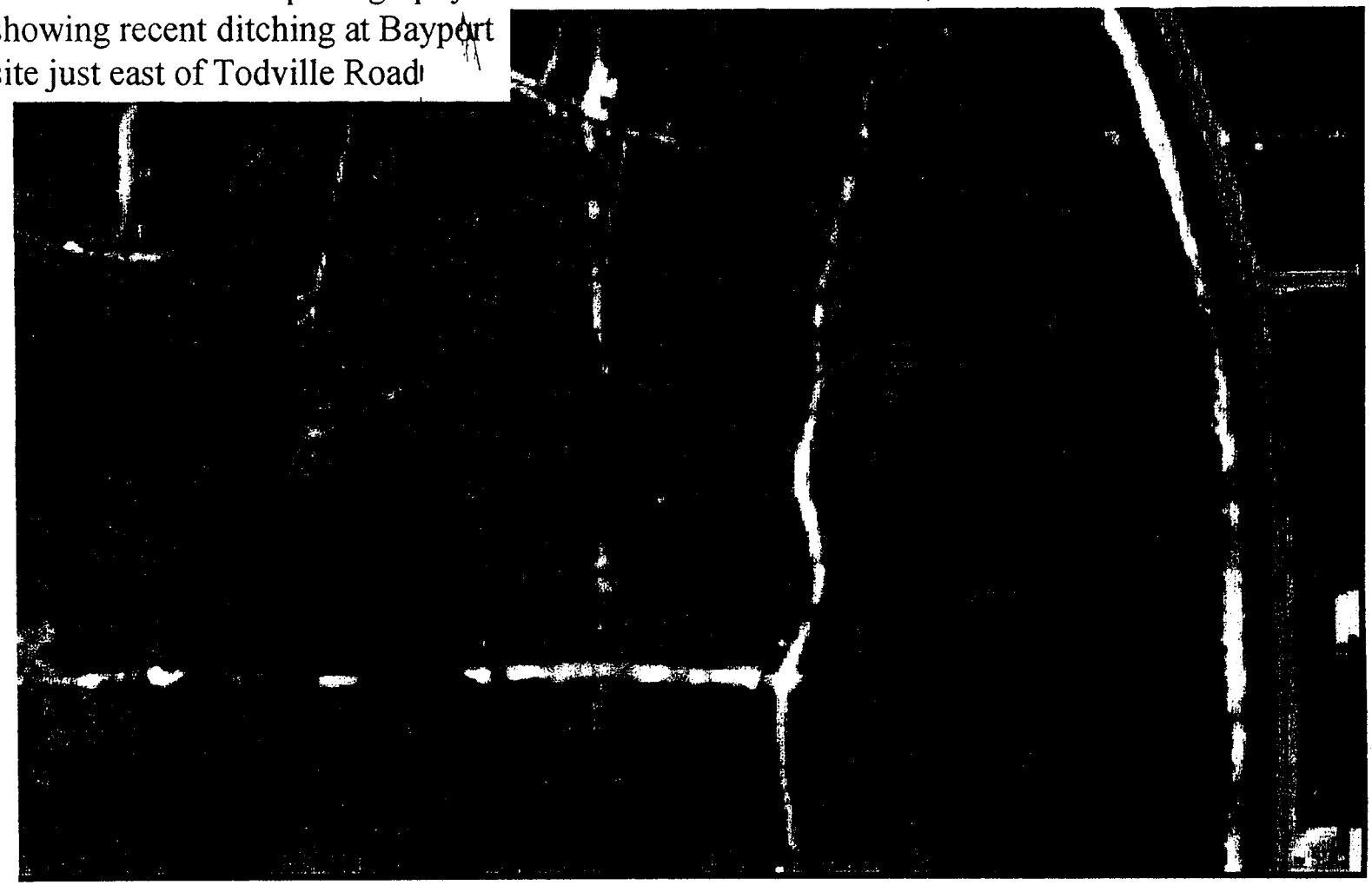
Jacob, J. Expert Report
Figure 11

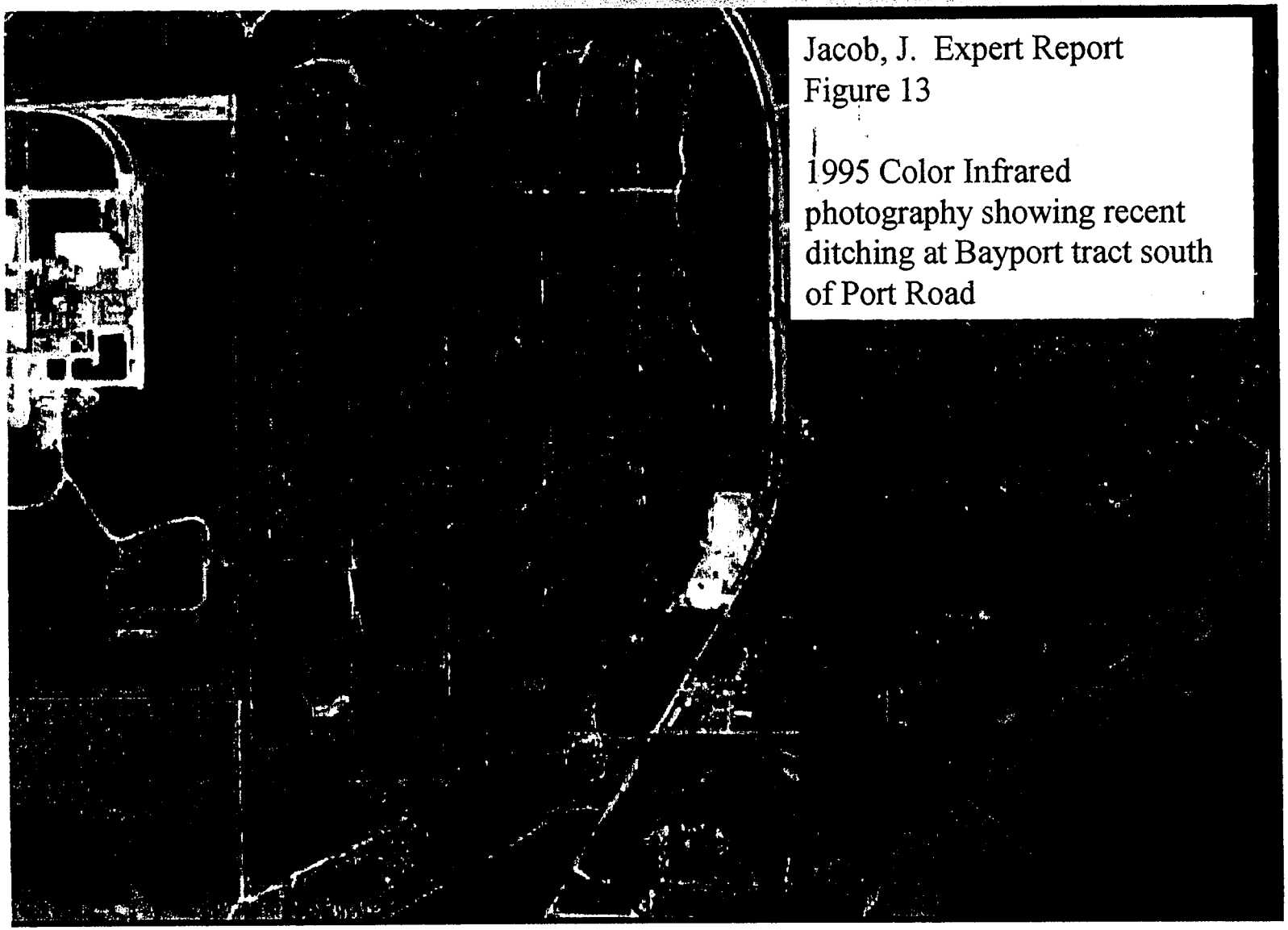
1995 Color Infrared photography showing recent ditching at Bayport site just south of Port Road



Jacob, J. Expert Report
Figure 12

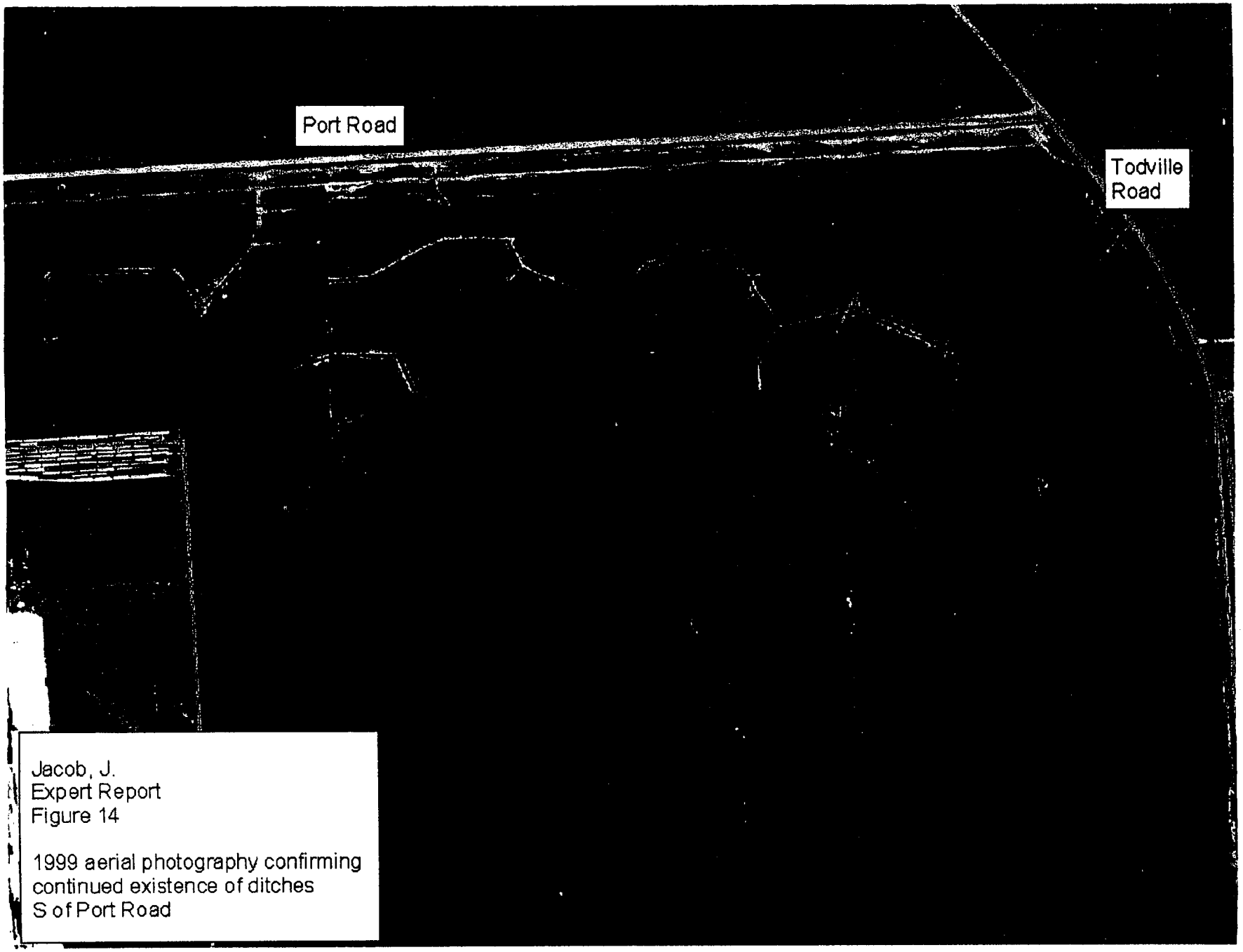
1995 Color Infrared photography showing recent ditching at Bayport site just east of Todville Road





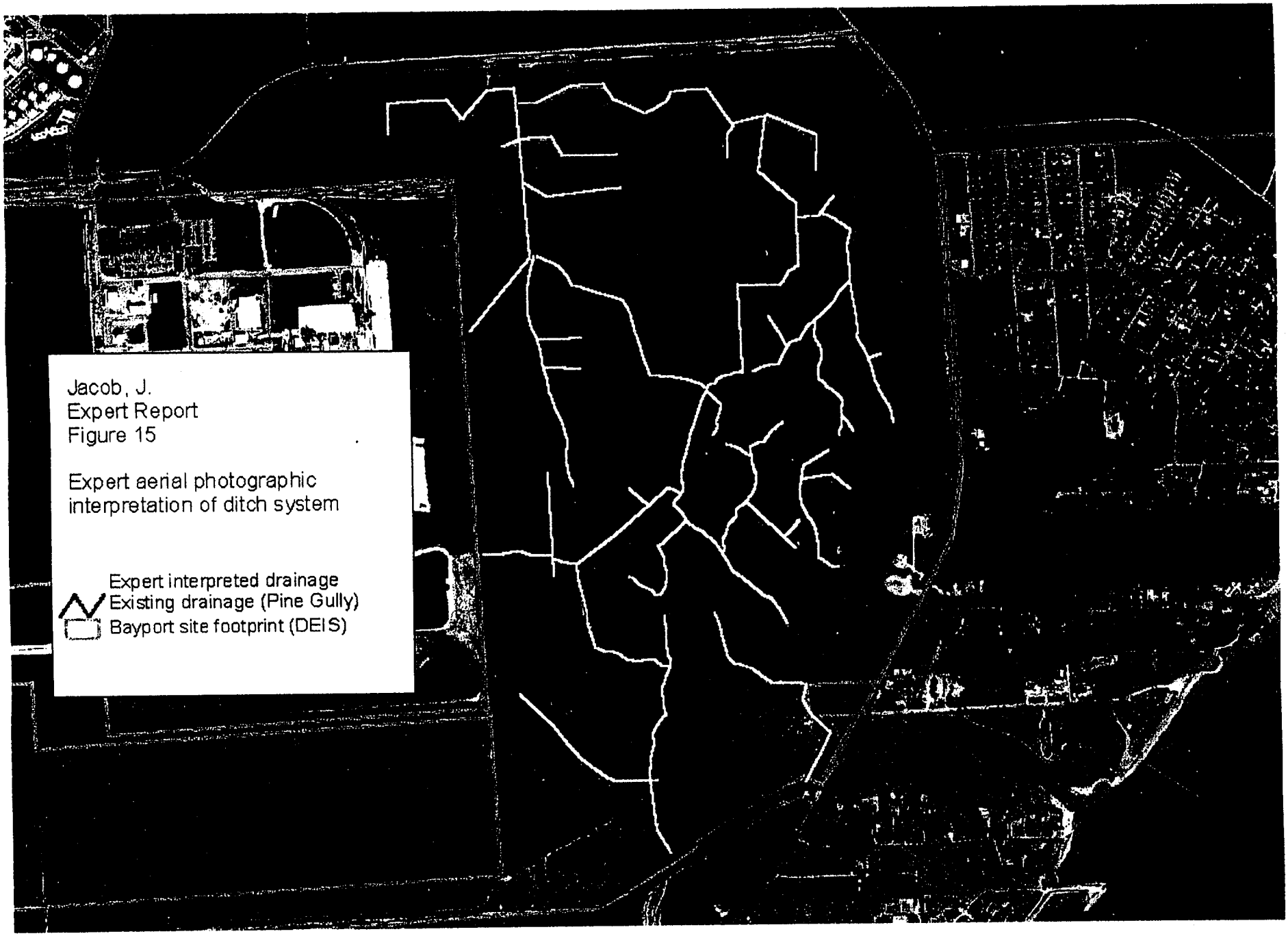
Jacob, J. Expert Report
Figure 13

1995 Color Infrared photography showing recent ditching at Bayport tract south of Port Road



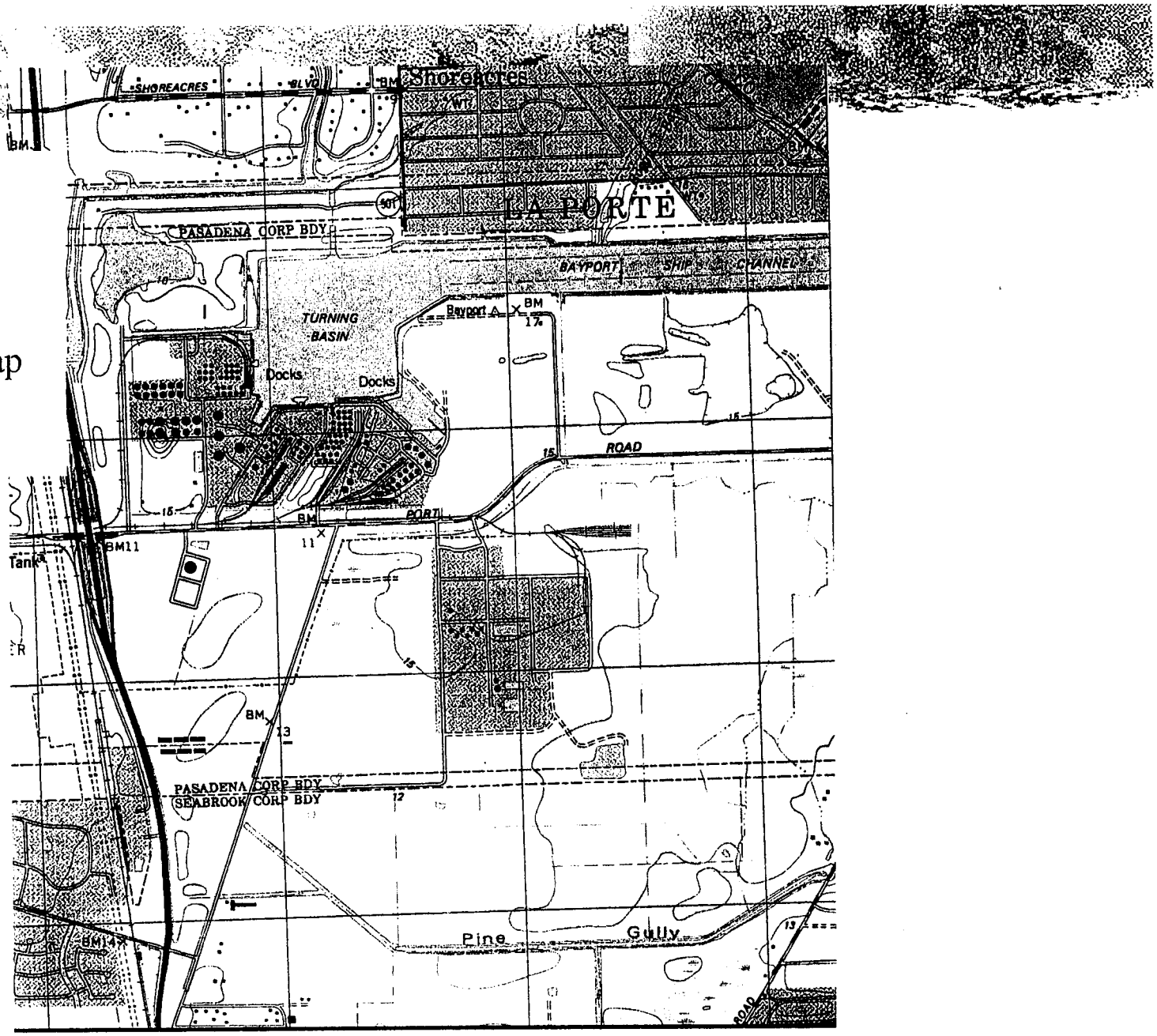
Jacob, J.
Expert Report
Figure 14

1999 aerial photography confirming continued existence of ditches S of Port Road

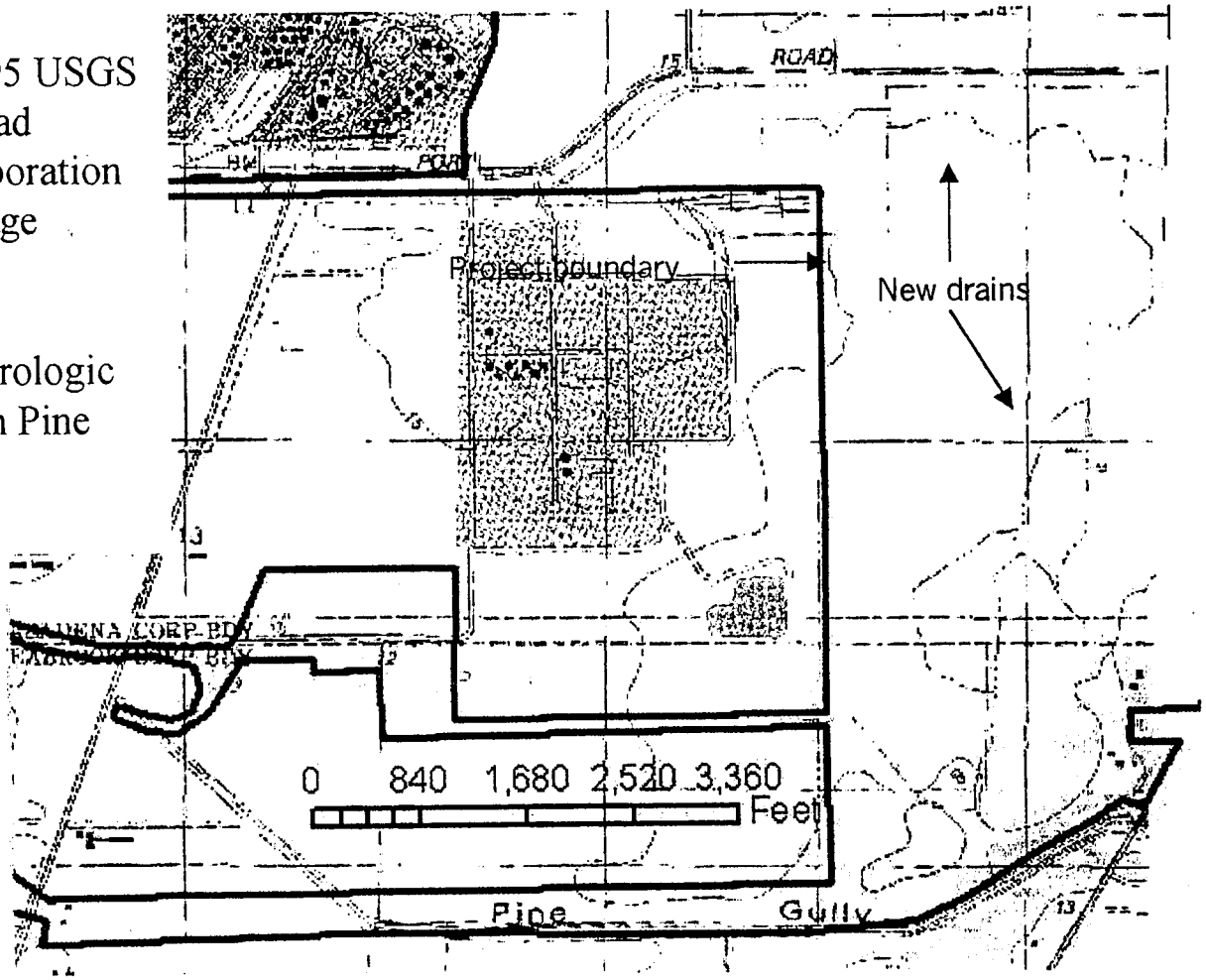

Jacob, J.
Expert Report
Figure 15
Expert aerial photographic interpretation of ditch system
Expert interpreted drainage
Existing drainage (Pine Gully)
Bayport site footprint (DEIS)

Jacob, J.
Expert Report
Figure 16
1995 League
City USGS map

(Excerpt)

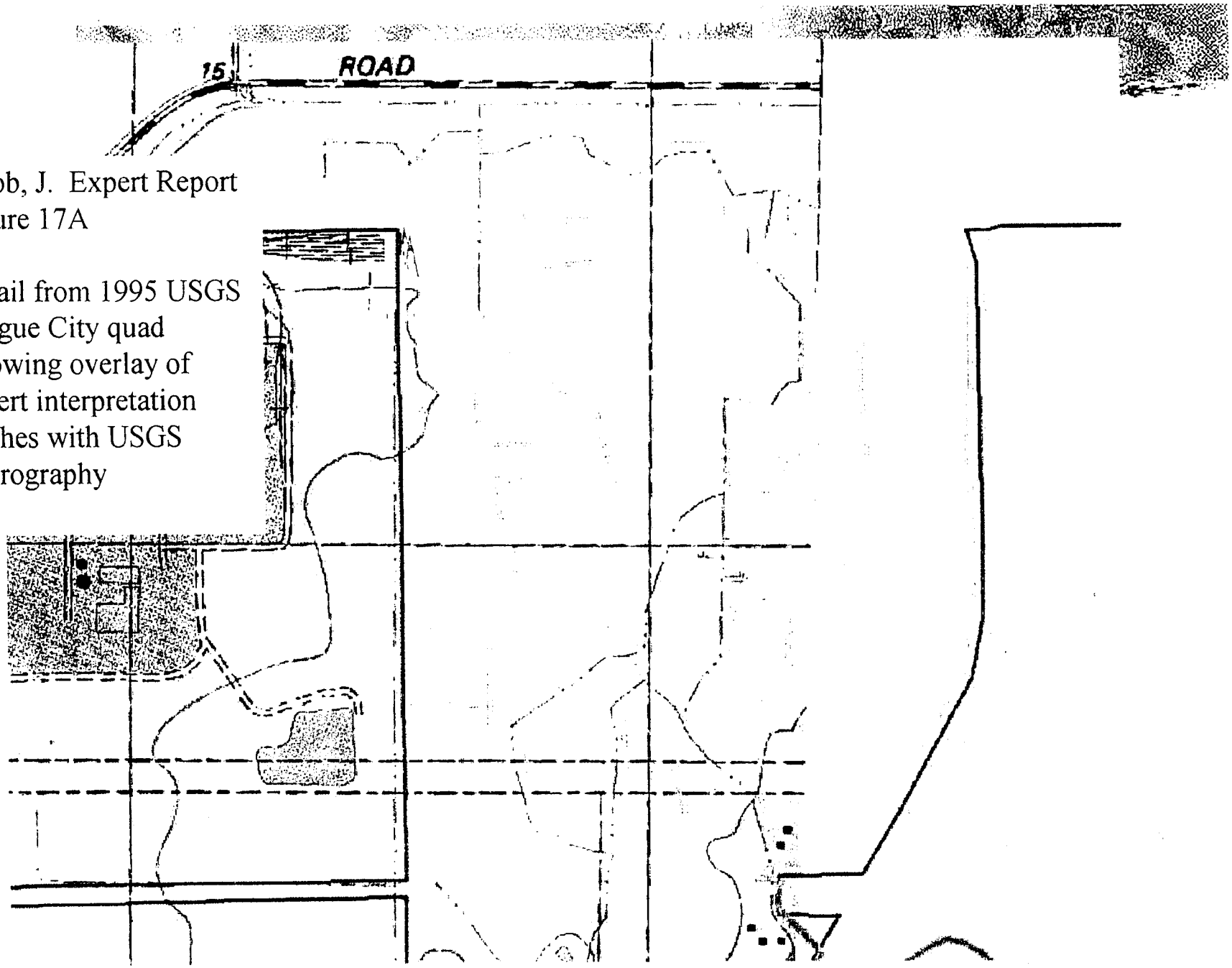


Jacob, J. Expert Report
Figure 17.
Detail from 1995 USGS League City quad showing incorporation of recent drainage into recognized hydrography.
Note direct hydrologic connection with Pine Gully.



Jacob, J. Expert Report
Figure 17A

Detail from 1995 USGS League City quad showing overlay of expert interpretation ditches with USGS hydrography

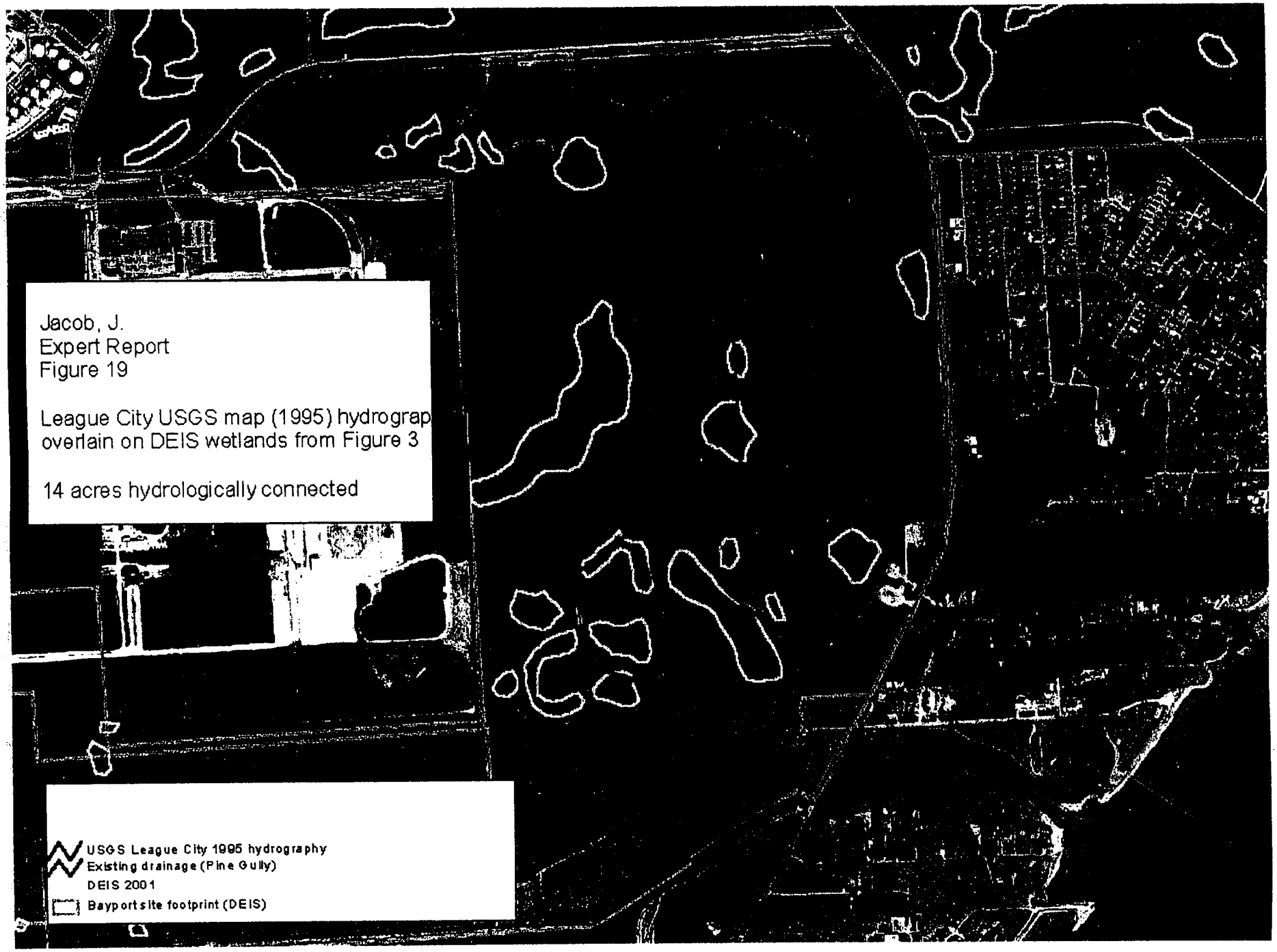


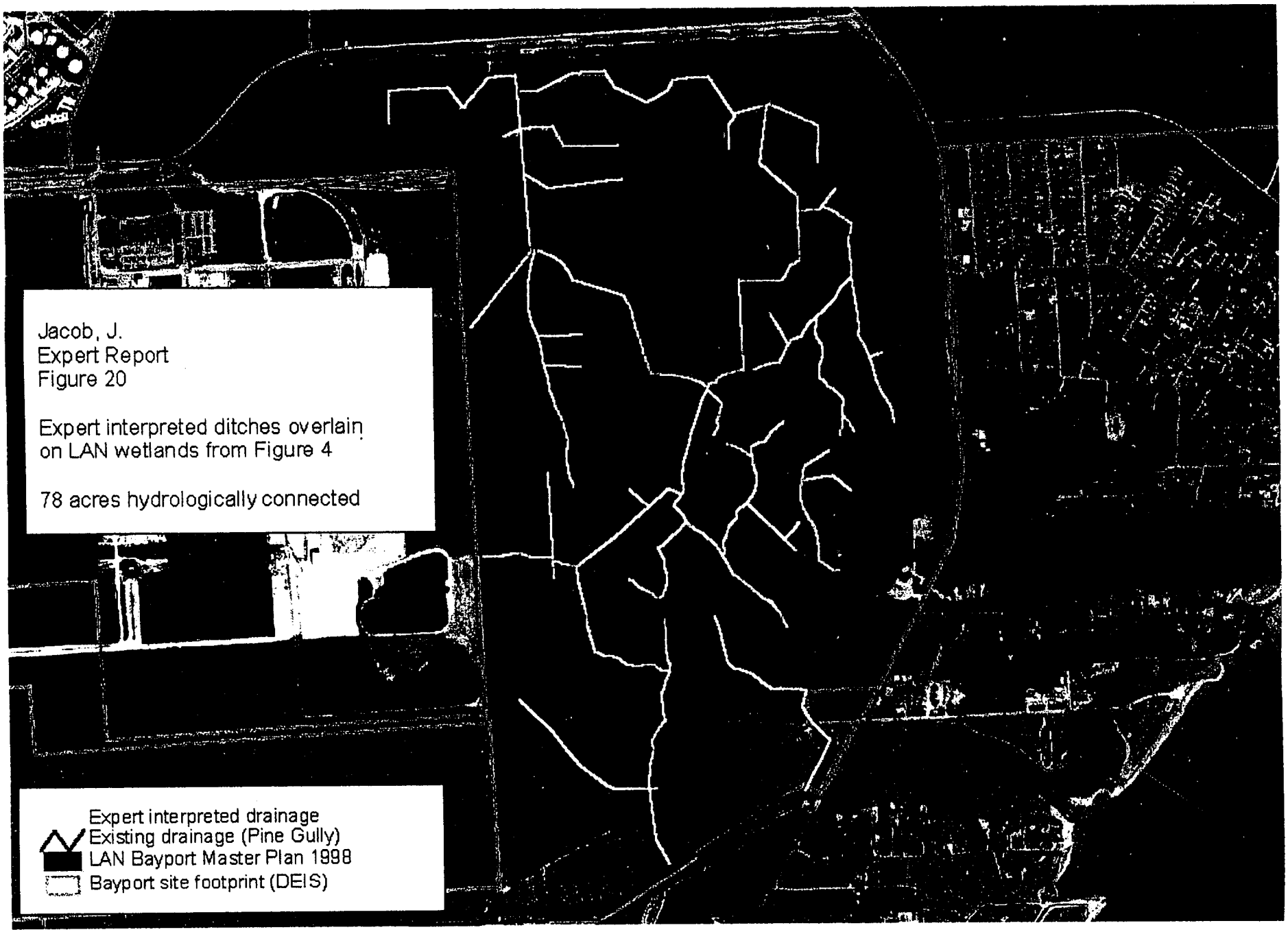
Jacob, J.
Expert Report

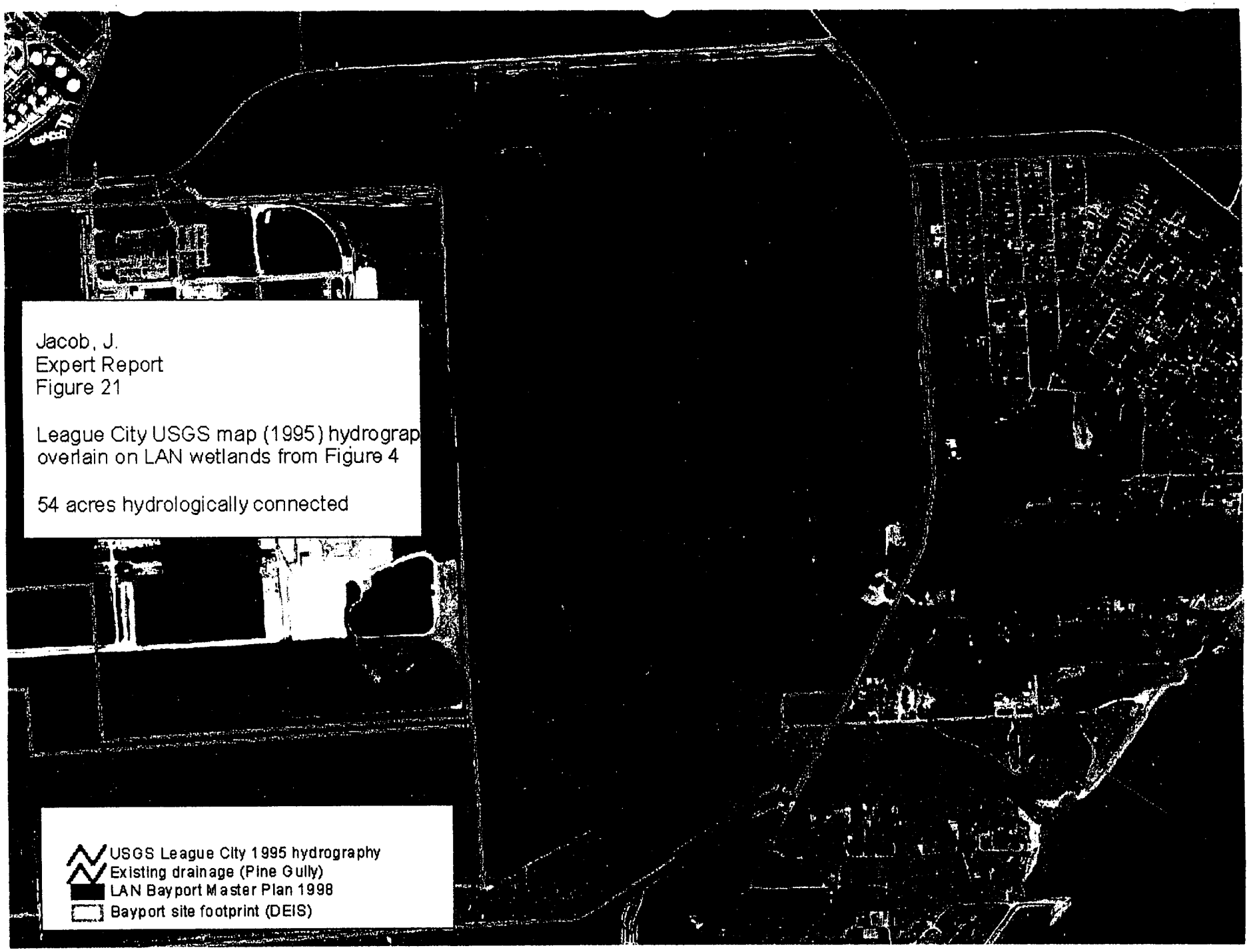
Figure 18

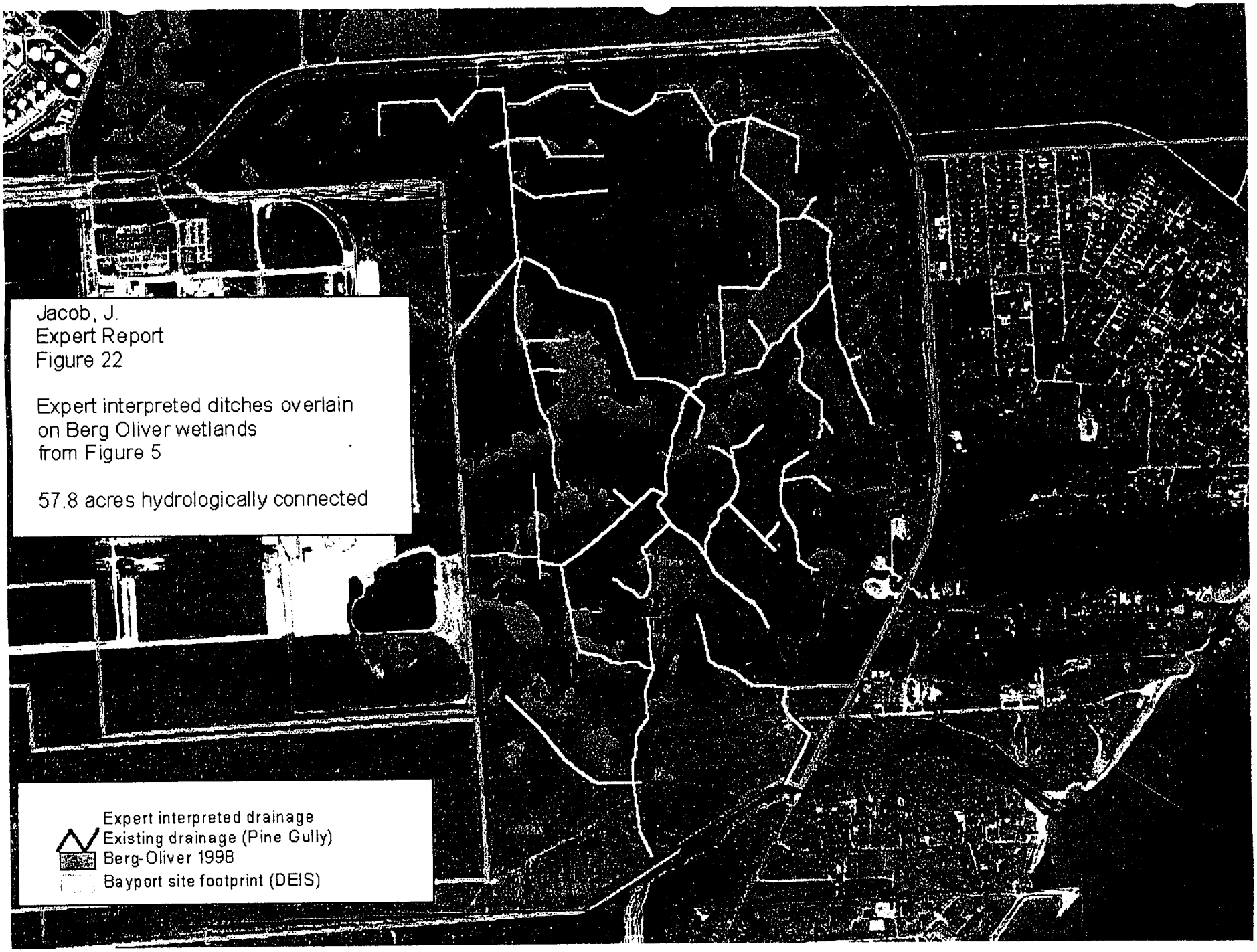
Overlay of expert interpreted ditches and DEIS wetlands from Figure 3

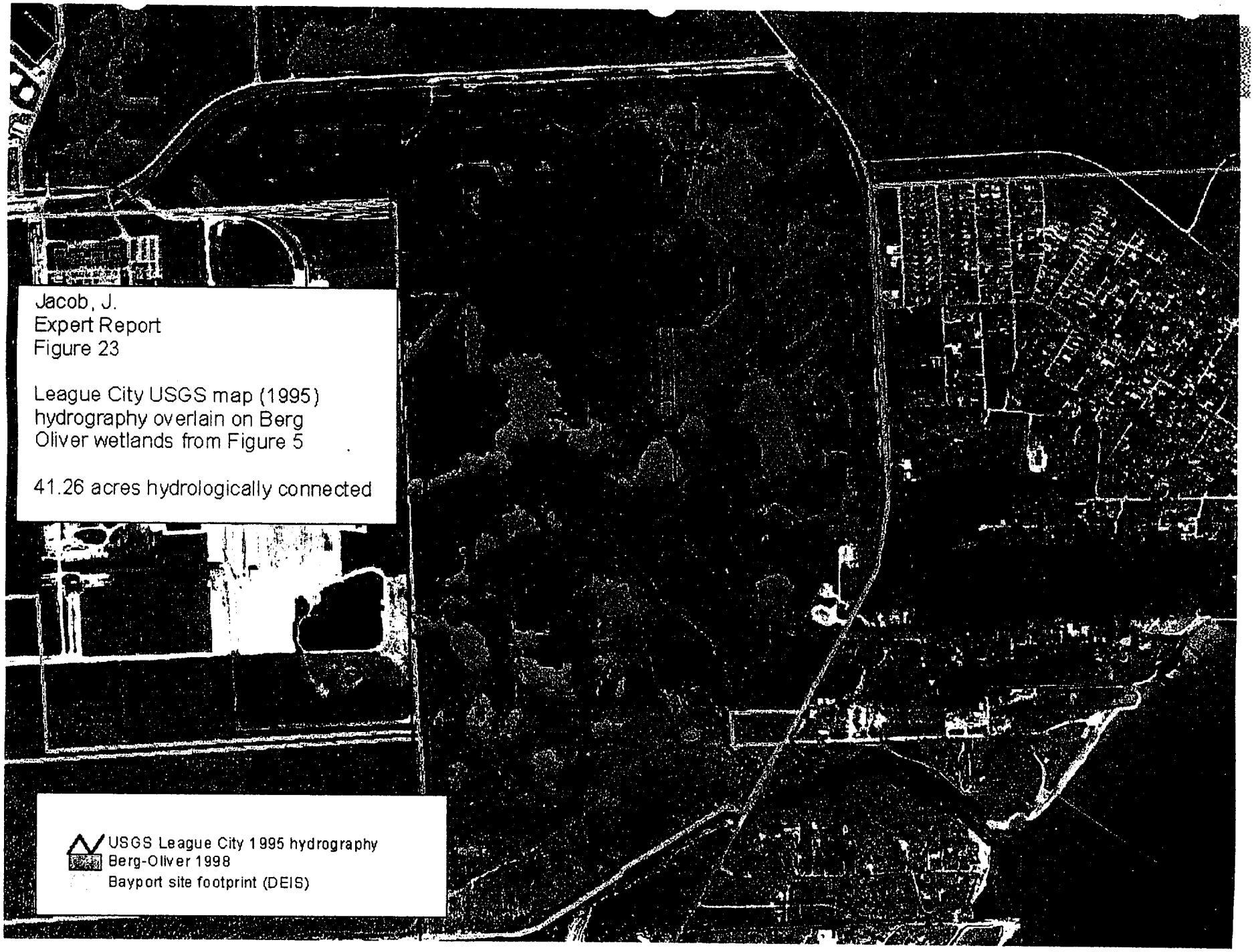
22.0 acres hydrologically connected


Jacob, J.
Expert Report
Figure 19
League City USGS map (1995) hydrograp
overlain on DEIS wetlands from Figure 3
14 acres hydrologically connected
USGS League City 1995 hydrography
Existing drainage (Pine Gully)
DEIS 2001
Bayport site footprint (DEIS)

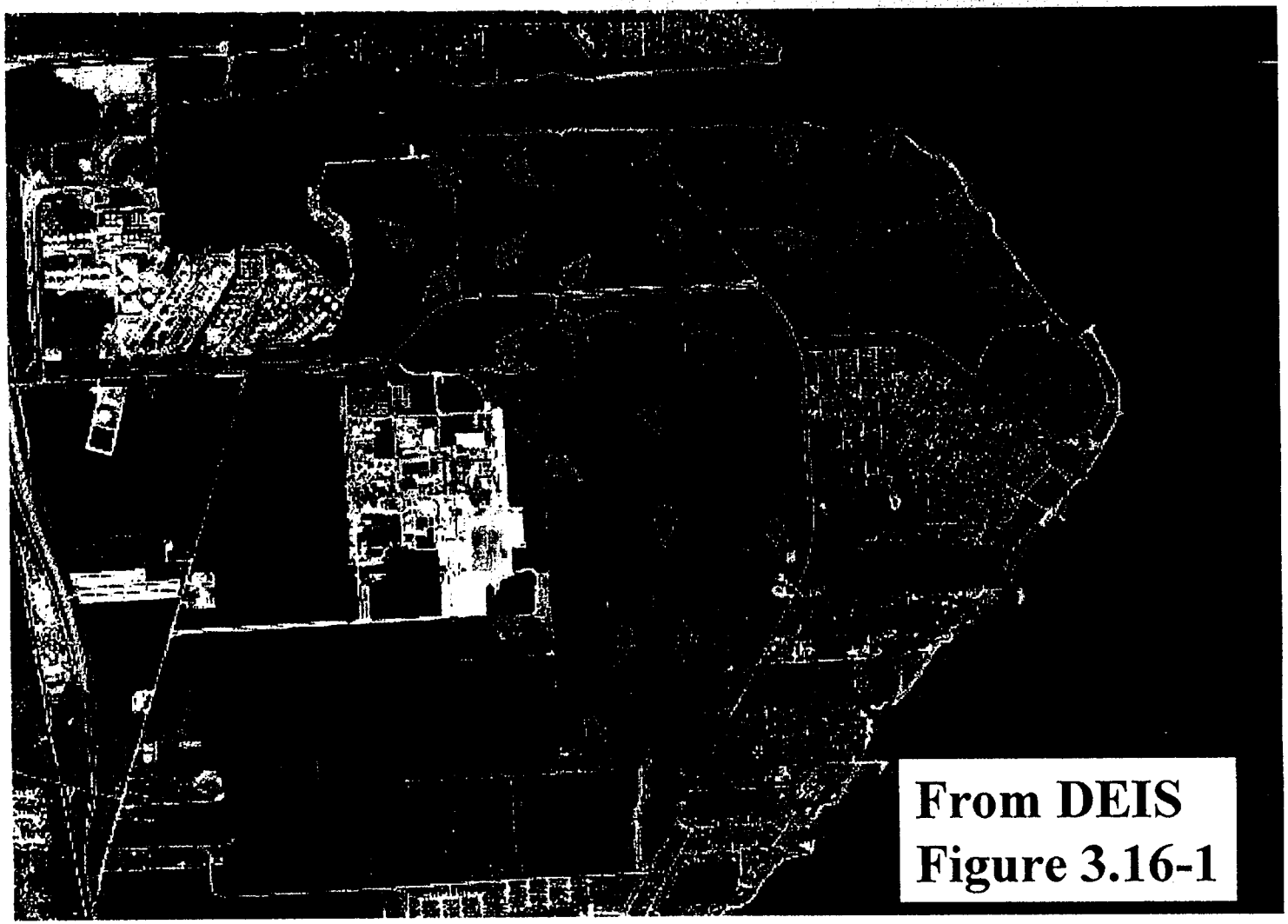

Jacob, J.
Expert Report
Figure 20
Expert interpreted ditches overlain on LAN wetlands from Figure 4
78 acres hydrologically connected
Expert interpreted drainage
Existing drainage (Pine Gully)
LAN Bayport Master Plan 1998
Bayport site footprint (DEIS)


Jacob, J.
Expert Report
Figure 21
League City USGS map (1995) hydrograp
overlain on LAN wetlands from Figure 4
54 acres hydrologically connected
USGS League City 1995 hydrography
Existing drainage (Pine Gully)
LAN Bayport Master Plan 1998
Bayport site footprint (DEIS)


Jacob, J.
Expert Report
Figure 22
Expert interpreted ditches overlain on Berg Oliver wetlands from Figure 5
57.8 acres hydrologically connected
Expert interpreted drainage
Existing drainage (Pine Gully)
Berg-Oliver 1998
Bayport site footprint (DEIS)


Jacob, J.
Expert Report
Figure 23
League City USGS map (1995) hydrography overlain on Berg Oliver wetlands from Figure 5
41.26 acres hydrologically connected
USGS League City 1995 hydrography
Berg-Oliver 1998
Bayport site footprint (DEIS)

Corps' Hydrologic Analysis Confirms "Hydrologic Connection"


From DEIS
Figure 3.16-1

DEIS Runoff Parameters Are Consistent with Hydrologic Connection for Entire Tract South of Port Road

Flood Event	Runoff Coeff., c	Rainfall Intensity, i	Drainage Area, A	Peak Runoff, Q
100 yr	0.35	1.94 in/hr	600 ac	407 cfs
25 yr	0.32	1.56 in/hr	600 ac	300 cfs
10 yr	0.30	1.31 in/hr	600 ac	236 cfs

Mean Annual Runoff	0.27	48 in	600 ac	650 ac-ft

Expert Opinion

John S. Jacob, Ph.D.
Professional Wetland Scientist, Certified Professional Soil Scientist

Wetland extent and significance at the proposed
Bayport Channel Container/Cruise Terminal site

January 2002

Appendix 2 – Additional means of hydrologic connection

There has been virtually no research on the hydrologic connections of Gulf Coast prairie pothole wetlands with local streams that might be classified as navigable waters. There are, however, sufficient lines of evidence that would indicate that a very profound hydrologic connection does indeed exist, and that Gulf Coast prairie pothole wetlands should be considered adjacent until proven otherwise.

A. Connections though paleo-channels.

As remnant features of fluvial deposition, prairie potholes are well established in the scientific literature (Bernard, et al., 1970; Aronow, 1976; Van Siclen, 1985; Fisher, et al, 1972). Ancient meander ridges, where the channels of the ancestral Brazos and other rivers flowed, are continuous for very long stretches, in many places across their entire original length. Paleo-channels on these meander ridges have, of course, been greatly modified in the 30,000+ years since they were formed. It is no longer possible to trace an intact channel from its origin all the way to the shore, but large sections of paleo-channels are easily detectable. Magnolia Creek in northern Galveston County, for example, is an ice-age remnant of a Brazos River channel that has enough continuity to be recognized as a modern "creek" by local residents.

In spite of marked geomorphological modifications since the potholes evolved from channels, it is difficult to find a pothole anywhere on the Gulf Coast without some kind of a surface connection to the next pothole. These hydrologic connections likely follow the traces of the ancient channels. Fig 4 shows a linear pothole complex on the Bayport site stretching from Todville Rd to the Bay. The dark linear areas between the larger potholes are lower than the adjacent, lighter-colored upland areas, and conduct water during overflow periods.

We can infer overflow of the prairie pothole wetlands, especially in the winter and early spring months from the rather shallow nature of the depressions (about 1 foot deep on the average). Assuming a wetland density of about 30% coverage, only 4 inches of rain under conditions of soil saturation would be enough to fill the potholes, a likely occurrence over the months indicated. The overflow water will flow preferentially along the paleo-channel remnants.

The subsoil connections are much more continuous than the surface connections. Almost all of the post depositional modifications to this landscape have been superficial, such that the subsurface stratigraphy is virtually unmodified. That means that the sand bodies associated with the original channels are continuous and unbroken along their entire length. These sand bodies have a distinct gradient or dip, such that water flows in them

hydrologically, in the sense of not having significant outfall. In this sense, all of the wetlands on the Bayport site are hydrologically connected to the Bay.

Figures

Fig 4b. Same as Fig. 4a, but with ridge highlighted in brown. DEIS and Berg wetlands are in shades of green. Red lines are the project boundary. Open blue arrows are areas of concentrated flow off of meander ridge to adjacent lower areas. The area labeled "Ba" is a low flat of the hydric Beaumont soil, which drains directly (solid blue line) into Pine Gully and thence to Galveston Bay.

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Aronow, S. 1976. Geology. In Soil Survey Staff. Soil Survey of Harris County. U.S. Department of Agriculture. U.S. Govt. Printing Office.

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Fisher, W.L., McGowen, J.H., Brown, L.F., and Groat, C.G. 1972. Environmental Geologic Atlas of the Texas coastal zone – Galveston-Houston area. University of Texas Bureau of Economic Geology. Austin.

Kadlec, R.H., and Knight, R.L. 1995. Treatment wetlands. CRC Lewis Publishers. New York. 893 p.

Moulton, D.W., and Jacob, J.S. 2000. Texas Coastal Wetlands Guidebook. Texas Sea Grant, Texas A&M University, College Station. TAMU-SG-00-605.

Mitsch, W.J., and Gosselink, J.G. 2000. Wetlands. John Wiley & Sons. New York.

Expert Opinion

Analysis of Drainage Features at Proposed Bayport Container Terminal Site

Lawrence G. Dunbar, P.E.

March 4, 2002

I have analyzed the drainage features of the site where the proposed Bayport container terminal is being considered to be constructed. I have performed this analysis in the context of whether the various wetlands that exist on the site should be classified as "adjacent wetlands", and thus jurisdictional under Section 404 of the Clean Water Act.

"Adjacency" for jurisdictional purposes can be established in a number of ways, according to the Galveston District of the Corps of Engineers, including by showing a "hydrologic connection" between the wetland itself and "waters of the U.S."

"Hydrologic connections" are defined by the Corps as surface tributary systems, surface water connections (e.g. ditches), or waters that are part of a surface tributary system during normal flows or predictable flood events. Therefore, I reviewed aerial photographs, authoritative material and other documentation to determine if a "hydrologic connection" could be established for the wetlands located on the Bayport site.

The Corps of Engineers prepared a Draft Environmental Impact Statement (DEIS) on the proposed Bayport container terminal. Contained therein is information regarding the site of the proposed terminal. For example, there are over 100 acres of wetlands identified to exist on the proposed Bayport site in the Corps DEIS. Furthermore, it is stated on page 3-16.15 of the DEIS that "...most of this area drains to Pine Gully as overland flow or through minor tributary channels." Pine Gully is a tidally-influenced tributary to Galveston Bay and is therefore considered "waters of

11842

Site Preparation for Construction of Proposed

SHOAL POINT CONTAINER TERMINAL

Prepared for

Houston - Galveston MEGAPORT

Texas City

Prepared by

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

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JAMES A. SHINER
REG. No. 26958
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PROFESSIONAL ENGINEER
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January 2000

TABLE OF CONTENTS

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Executive Summary	1
Introduction	2
Approach	3
Site Preparation Strategy	5
Conclusions and Recommendations	7

EXHIBITS

Exhibit 1 – Report of Preliminary Geotechnical Exploration

Exhibit 2 – Option A Construction Sequence and Costs

Exhibit 3 – Option B Construction Sequence and Costs

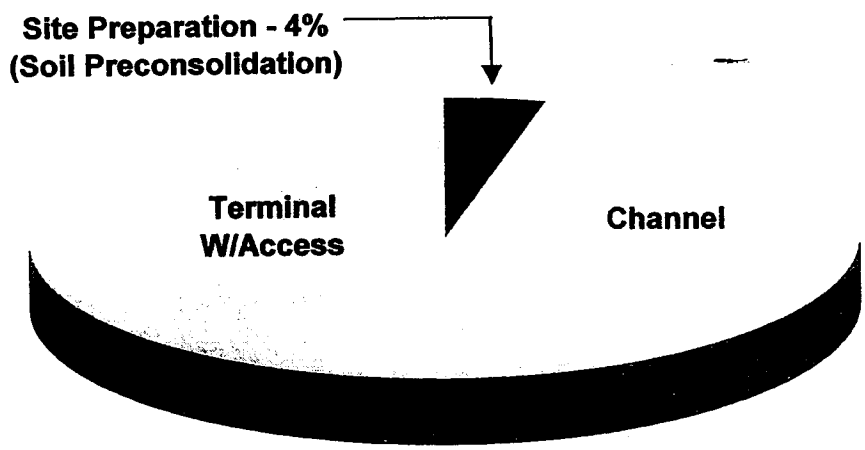
Exhibit 4 – General Information on Wick Drain Installations

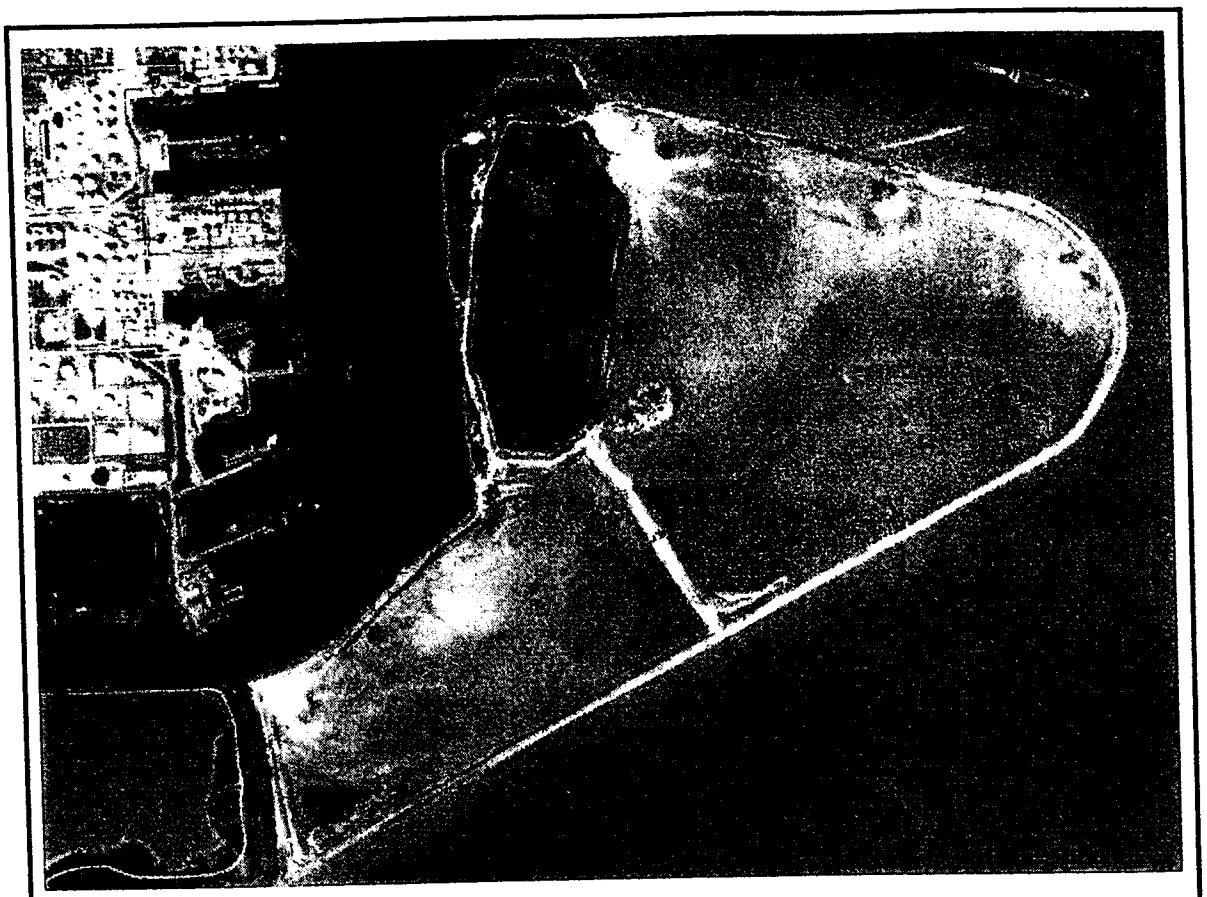
Exhibit 5 – Miscellaneous Photographs of Actual Wick Drain Installation

EXECUTIVE SUMMARY

The fact that Shoal Point has been used for dredged material disposal does not impair its future as a major container terminal. Shoal Point has better soil conditions than those found at other major container terminals such as Wando or Daniel Island in Charleston, South Carolina. A preliminary geotechnical investigation has shown that with a soil preconsolidation program using a wick drain system and soil surcharge, the site could be ready for terminal construction in 18 to 30 months after starting site preparation activities.

Initial site preparation will cost an average of $52,000 per acre for the 210-acre site, or a total of about $11 million. To reduce future construction time and costs, it is recommended that a pavement subsurface foundation referred to as a "bridge lift" be built concurrent with the site preparation activities at an additional cost of $38,000 per acre, for a total of $90,000 per acre or $19 million for the entire 210-acre site. This would increase the overall reported project cost of $500 million by less than 4%, an amount that should not jeopardize the project's economic feasibility.





Shoal Point, Texas City, Texas

INTRODUCTION

Authorization. This investigation was authorized by the City of Texas City to determine the feasibility and conceptual level costs of site preparation for a new container shipping terminal at Shoal Point.

Purpose. The use of Shoal Point as a container terminal will require that its soils support the heavy loads of stacked containers without significant settlement. Historically, the site has been used for dredged material disposal. These dredged materials are often very soft and wet when placed, and can take many years to consolidate and strengthen.

The concern was that these soft soils, if not stabilized, would settle under the heavy container loads, damaging pavement and utilities, and that improving the soils could make this site prohibitively expensive to develop for container terminal use. This

preliminary investigation was to sample and test the soils, and investigate methods and costs for improving the soils to carry container loads without excessive settlement.

APPROACH

The Team. A key to a credible investigation is to have a well-qualified team. S&ME, Inc., a leading geotechnical engineering firm in the southeast United States, has successfully developed several container terminals on soft, dredged material disposal sites. In Charleston, SC, they planned the improvements on the completed Wando Terminal and the planned Daniel Island Terminal. Shiner Moseley's project manager, Jerry Hauske, P.E., served as project manager on the Wando Terminal project for the Port of Charleston, and in this role worked closely with S&ME in planning those site improvements. S&ME's expertise with soils improvement for container terminals helps to insure that this preliminary investigation provides credible results.

Exploration and Testing. The first step of this preliminary investigation was to obtain and review past soil test reports that have been done at or near the site. Because the site has been a U.S. Army Corps of Engineers (USACE) dredged material disposal site and is adjacent to a federal channel, a number of soil borings have been done at the site. Logs of borings were obtained from the USACE for the years 1978 and 1987. These were reviewed and then a drilling program of eight borings to depths of 70 to 90 feet was planned and carried out.

A dried crust layer 3 to 5 feet thick underlain by 20 to 35 feet of very soft to firm clay was found during the drilling program. Under this was a 10 to 20-foot thick dense sand layer followed by firm to very stiff clays and silts. After running a wide range of tests on samples of these soils, it was then possible to make preliminary estimates of potential settlement magnitude, develop methods for improving the site, and prepare preliminary opinions of probable construction cost to achieve the improvements.

Methods for Soils Improvement. To prevent soft, wet soils from settling too much after construction of the container terminal, a soil preconsolidation program is necessary before construction. For the types of soils at the site, S&ME has recommended a method that:

- Allows water that is trapped in the soft soils to escape to the surface through a system of specially designed vertical wick drains, horizontal strip drains, and a series of drainage ditches.

- Places a large surcharge weight over the surface of the site, typically several feet of soil, to squeeze the soft soils together and to force the water out.

This method has been used successfully in the construction of several major container terminals. General manufacturer/installer information for wick drain systems and photographs of actual installations where these techniques were used are provided in Exhibits 4 and 5 in the Appendix.

For Shoal Point, a specific plan was developed based on the soil testing that considered:

- Length and spacing of wick drains,
- Amount of fill needed to provide adequate surcharge weight,
- Length of time needed to consolidate the soils, and
- Amount of settlement that can be tolerated after the container terminal is constructed.

S&ME developed generalized conceptual costs to allow optimization of the above factors. Their costs also were based on developing the whole site at once, rather than in a more probable and less costly phased approach. They were also focused on the intent of comparing factors such as amount of fill needed and the spacing of the wick drains. The overall costs were subsequently optimized by Shiner Moseley to more accurately represent phasing of the work and local construction costs expected in the Galveston Bay Area.

The Report of Preliminary Geotechnical Exploration prepared by S&ME is included in Exhibit 1 in the Appendix. A key conclusion of S&ME was that:

> "Overall, subsurface conditions across Shoal Point are considerably better than the conditions encountered at other major container terminal sites of similar history (i.e., old dredged material disposal sites) in the Charleston, South Carolina and Savannah, Georgia vicinities...the Shoal Point site can be ready for construction within one to two years of implementing a soil preconsolidation program, and that the cost of such site preparation should not be a major cost factor in determining the economic feasibility of developing a container terminal at the site."

SITE PREPARATION STRATEGY

Site Considerations. Because of Shiner Moseley's familiarity with the Shoal Point project and their many years of engineering waterfront facilities in Texas, tailoring the S&ME results to a phased project development plan, local costs and other site specific aspects was their responsibility. Factors such as the cost of fill, sequencing of project phases, and details of staging of the construction greatly affect the cost of the work.

Imported Fill. There will be a large amount of fill needed to provide the consolidating surcharge weight. Much of this fill must be sandy so that it will provide adequate foundation support for future ground-supported structures and site improvements such as pavement and underground utilities, etc. Because of the large quantity of soil needed (approximately 1,000,000 CY), the cost of this material greatly affects the overall cost of improving the underlying soils.

Construction Phasing. It is not expected that the entire 210 acres of the terminal site would all need to be developed at once. Typically container yards can be set up in increments of one-third this size; therefore, 70 acres works well. It is presently planned the site would be developed in three stages of 70 acres each. This will allow reuse of surcharge material, reducing the volume that needs to be imported. This, in turn, will reduce costs.

Site Preparation. While there are several ways of optimizing the process of site preparation, for this preliminary investigation the expected method is shown in Exhibit 2 in the Appendix and will be generally as follows:

Step 1. Excavate approximately 3 feet below the proposed pavement section subgrade to remove soft soils that are not suitable near the future surface.

Step 2. Install geotextile subgrade reinforcement and a 1-½ foot lift of imported sandy fill to provide a stable work platform for wick drain installation equipment to operate on.

Step 3. Install vertical wick drains and horizontal strip drains.

Step 4. Place another 1-½ foot lift of sandy fill over the horizontal strip drains to complete a bridge lift.

Step 5. Place the surcharge fill approximately 6 feet high. This will provide the weight needed to consolidate the soils underneath.

Step 6. After the required consolidation period, remove the surcharge fill. The removed fill will be placed on the second 70-acre site and the sequence will be repeated.

Integrating Soil Preconsolidation with Pavement Section. To give an accurate cost for the soil improvement, the costs of constructing subsequent pavement section need to be considered. Container yards require very heavy-duty pavement. Even in areas of very good soils, significant work is done in the top few feet to strengthen the soils to support the pavement. In carrying out the improvements for the soil settlement situation, some of the work for the pavement is initially done to reduce future paving costs. One common technique, referred to as a bridge lift, involves the use of a several foot thick dense layer of sand to distribute loads over underlying soft soils. This has been considered in the costs presented in Exhibit 2 in the Appendix, which shows the basic preconsolidation costs and the incremental costs of the bridge lift.

Post-Construction Settlement. It is common practice to allow for some amount of post-construction settlement when designing container yards for very heavy loads. For example, the planned Daniel Island Terminal in Charleston was designed for a total nine-inch uniform settlement. The projected settlement for the recommended preconsolidation efforts at Shoal Point is seven inches. This settlement does not cause any long term problems.

Site Preparation Time. Site preparation cost varies inversely with the site preparation time. It is more costly to consolidate the soils quickly since more surcharge material is required to force the moisture out through the drainage system, and the cost of obtaining and trucking the material to the site can be significant. The recommended program for Shoal Point presented herein would have the first 70-acre phase ready for construction in 18-30 months, with another 2-4 years required for the remaining 140 acres.

Costs. Using the previously mentioned settlement and timing criteria, it is expected that the basic preconsolidation work will cost an average of $52,000 per acre. This would total approximately $11 million for the entire 210-acre site. The future costs of providing a heavy-duty pavement section can be significantly reduced at the time of preconsolidation work by incrementally constructing the bridge lift at the same time. This will add another $38,000 per acre for a gross per acre cost of $90,000 or a total of $19 million for the 210-acre site. Additional details on these estimates of probable cost are contained in Exhibits 2 and 3 in the Appendix.

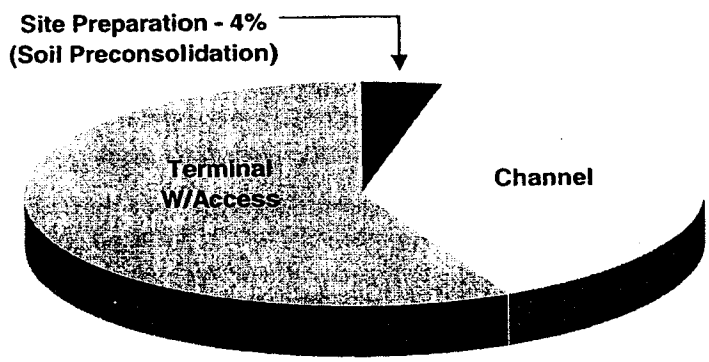
CONCLUSIONS AND RECOMMENDATIONS

- Soft soils do exist at Shoal Point; however, they are better than those found at many other major container terminals.

- Proven technology readily exists that can be used to stabilize the site and have the initial phase ready for the construction of the container terminal within 18-30 months of starting site preparation activities.

- The total cost of site preparation – including the advance installation of a "bridge lift" to reduce future paving costs is $90,000 per acre or $19 million for the 210-acre site.

- The cost of soil preconsolidation and construction of the bridge lift should not significantly impact the overall economic viability of the project since it amounts to less that 4% of the total reported project cost of $500 million.



- It is recommended that a definitive soil preconsolidation program be adopted and be ready for immediate implementation at such time as funding commitments and regulatory approvals are obtained.

EXHIBIT 1

Report of Preliminary Geotechnical Exploration

1.0 Introduction
2.0 Scope of Exploration
3.0 Site and Subsurface Conditions
4.0 Geotechnical Task Overview
5.0 Results of Settlement Analyses
6.0 Construction Issues
7.0 Conclusions and Recommendations

REPORT OF PRELIMINARY GEOTECHNICAL EXPLORATION

PROPOSED SHOAL POINT CONTAINER TERMINAL TEXAS CITY, TEXAS S&ME JOB NO. 1131-99-488

Prepared By:

S&ME, Inc.
840 Low Country Boulevard
Mount Pleasant, South Carolina

Forrest W. Foshee
Project Manager

Jack Amar, P.E., V.P.
Sr. Project Engineer

January 12, 2000

S&ME

January 12, 2000

Mr. Gerald J. Hauske, P.E.
Shiner, Moseley and Associates, Inc.
2820 South Padre Island Drive, Suite 210
Corpus Christi, TX 78415-1818

Re: **REPORT OF PRELIMINARY GEOTECHNICAL EXPLORATION**
Proposed Shoal Point Container Terminal
Texas City, Texas
S&ME Job No. 1131-99-588

Dear Mr. Hauske:

We have completed our preliminary geotechnical study of dredge disposal Cell C on Shoal Point, in Texas City, Texas. Our services were provided in general accordance with S&ME Proposal No. 31-99-203, dated August 20, 1999. The purpose of this work was to determine the typical site subsurface conditions within Cell C, and then to evaluate the conditions with regard to the feasibility of developing the site into a container-shipping terminal.

We sincerely appreciate the opportunity to assist Shiner, Moseley and Associates with this ambitious project. If you have any questions, please do not hesitate to call.

Sincerely,

S&ME, Inc.

Gregory J. Canivan
Staff Professional

Forrest W. Foshee
Project Manager

Jack Amar, P.E., V.P.
Senior Project Engineer

GJC/FWF/JA/jfc

S&ME, Inc.
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EXECUTIVE SUMMARY

1. Preliminary estimates of settlement magnitude, required fill quantities, and cost[1] have been made for stabilization of the proposed container yard site (the 100+/- acre, Cell C of Shoal Point), by the conventional method of surcharging with wick drains.

2. The average existing grade across the site is typically about 18 NAVD'88, and a target terminal subgrade elevation of 18 NAVD'88 has been used in our analyses. Live loading was assumed to be 1150 psf. Surcharge periods of 1 and 2 years were considered. Wick drains were spaced in a triangular pattern on 3-ft, 5-ft, 7-ft, or 9-ft spacings.

3. Various combinations of wick drain spacings, surcharge heights and surcharge times were identified that would limit post-construction primary consolidation settlements to 2 in., 3 in., 5 in., or 9 in. The remaining primary consolidation settlement would occur over the first 10 years of live loading. Secondary compression is expected to possibly result in up to an additional 2 in. of settlement over a period of 10 to 50 years.

4. The analyses were performed for one model soil profile (34-ft clay thickness), and the results presented on a per acre basis.

5. Cost estimates are based on: a $6.00/CY fill cost, a spoil undercutting and disposal cost of $2.00/CY, a cost of $2.50/CY for stripping and replacement of surcharge fill, a cost of $1.50/CY for surcharge fill removal and storage on-site, a cost of $2.50/SY for a geosynthetic layer necessary to reinforce spoil subgrades, and a wick drain cost of $0.50/LF.

6. For the 1-yr surcharge period, a wick drain spacing of 7 ft is the most economical for all but the 9-in settlement criterion, where a 9-in wick spacing is more economical. For the 2-yr surcharge period, a 9-in wick spacing is the most economical option for all but the 2-in. settlement criterion, where a 7 ft wick spacing is still the most economical. Estimated fill demands[2] for the most economical combinations of wick drain spacing and surcharge fill ranges from about 11,000 CY/acre to 17,500 CY/acre depending upon the allowable surcharge time and selected settlement criterion. Total earthwork costs for the most economical wick/surcharge combinations range from about $110,000/acre to $190,000/acre.

7. Overall, subsurface conditions across Shoal Point are considerably better than conditions we have encountered at other major container terminal sites of similar history (i.e., old dredge disposal areas) in the Charleston, South Carolina and Savannah, Georgia areas. For the same post-construction performance criteria, our analyses indicate that site preparation costs for a Shoal Point container terminal should be less than half those we have calculated for a major new terminal site (Daniel Island) in Charleston. Therefore, we conclude that the Shoal Point site can be preconsolidated and ready for construction within one to two years , and that the cost of such site preparation should not be a major cost factor in determining the economic feasibility of developing a container terminal at the site.

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[1] Cost = Cost for earthwork related materials and services only, including site preparation, temporary fill drainage, wick drains, and fill placement. Costs such as final subgrade preparation and paving, permitting, utilities, construction management, and quality control, etc. have not been considered.

[2] Fill Demand = The total amount of fill that is required to preconsolidate the site to the target subgrade elevation, (with the given amount of post-construction primary consolidation settlement, for a certain wick drain spacing. It roughly equals the amount of fill necessary to simulate the pavement and container loading, plus the amount of fill required to make up for the settlement induced by the surcharge.

1.0 INTRODUCTION

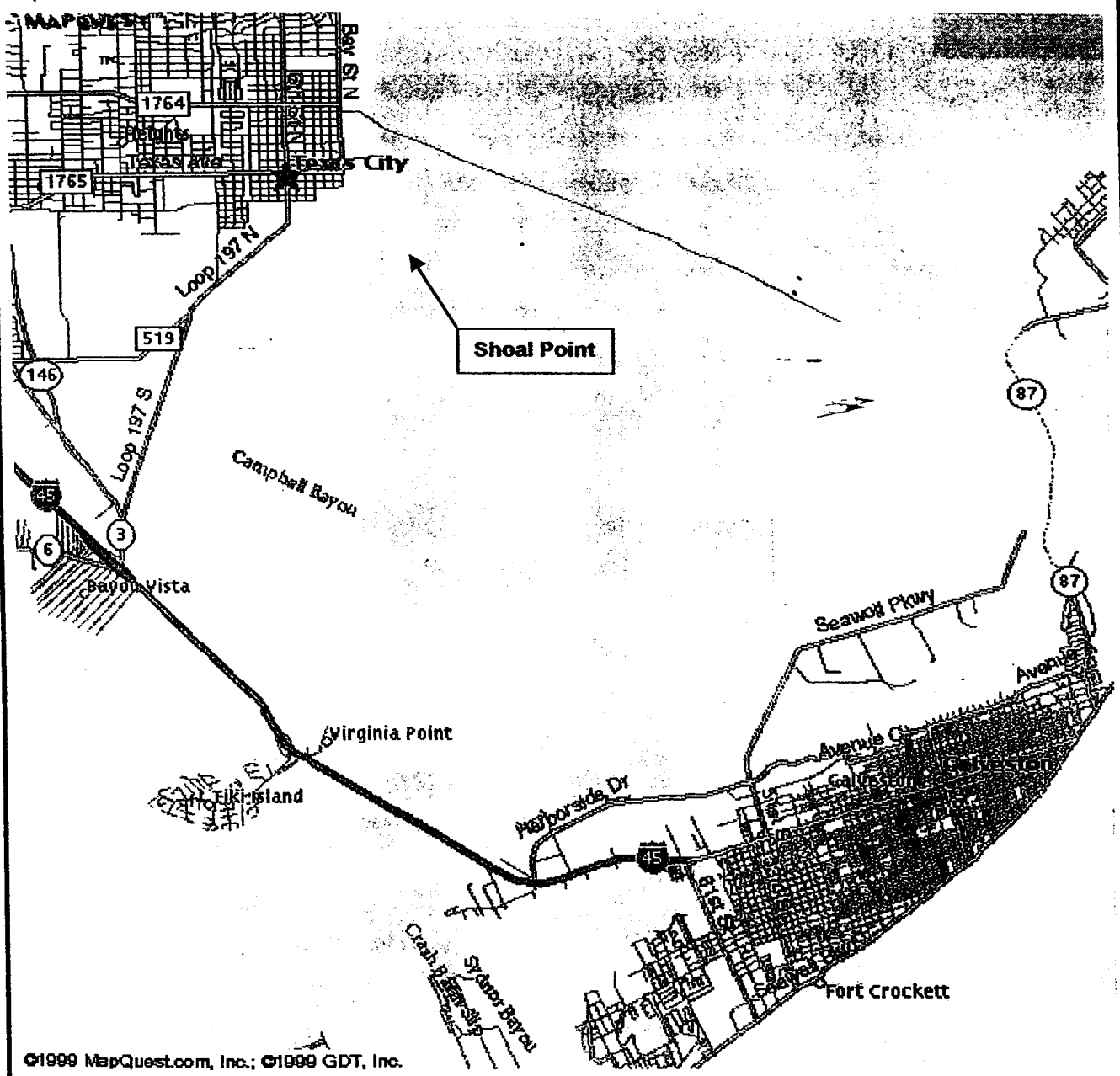
1.1 PROJECT INFORMATION

Market analyses[3] have determined that new container shipping terminals will be needed in the Texas Central Gulf region. Shoal Point, a 500+ acre peninsula composed of dredge disposal "cells", is being considered as a location for construction of a new container terminal. The site is located near Texas City, Texas, as shown on Figure 1. We understand the proposed development consists of typical container terminal construction: including waterside wharves and fill containment structures, paved container yards, rail yards and other shipping areas, and support facilities such as freight stations and transit sheds. Based on our experience with similar projects, we assume that the main structural loads that will affect design of the terminal come from the shipping containers, which typically impart an areal live loading of up to 1000 psf when fully-loaded and stacked 4-high.

We understand there are concerns that Shoal Point cannot support a container terminal due to its history as a dredge disposal site. Based on historical site data, including U.S. Army Corps of Engineers (USACOE) boring logs and laboratory test data, it has apparently been assumed that the subsurface conditions across the disposal site consist of "unstable" surficial deposits of soft compressible silt and clay, underlain by more stable sand and stiff clay/silt. These USACOE boring logs do indicate that areal loads from elevating fill and stacked shipping containers will result in some long-term settlement within the soft clays and silts. However, we have been intimately involved in the design of other major container terminals (e.g., the South Carolina Ports Authority's Wando, North Charleston, Columbus St. and proposed Daniel Island terminals in Charleston, and the Georgia Ports Authority's Berth 7, Area 2 in Savannah), where the site subsurface conditions were much worse than the apparent conditions at Shoal Point.

[3] Texas Deep Water Container Terminal ('Mega Port') - Conceptual Development Study of Shoal Point For the City of Texas City – PHASE 2 – EXECUTIVE SUMMARY, August 1998, Vickerman, Zachery, Miller.

Site Location Map



Note: Not To Scale

Job No : 1131-99-588 Date: November 8, 1999	S&ME	**Site Location Map** Proposed Shoal Point Container Terminal Texas City, Texas	Figure No: 1

1.2 OBJECTIVES

S&ME, in conjunction with Shiner, Moseley & Associates implemented this preliminary geotechnical study of Cell C to determine the feasibility of developing the site into a container terminal. In very broad terms, our objectives were: 1) to determine the site subsurface conditions, 2) to evaluate the feasibility of various site development options (with regard to time, performance and cost), and 3) to provide cost estimates for the various alternatives. Specifically, our field exploration and testing was directed toward defining the depth and extent of the soft compressible dredge spoil, and the nature of the underlying virgin deposits. Subsequent laboratory testing was performed on representative samples to determine parameters necessary for our settlement analyses. Our engineering analyses then focused on: 1) defining the magnitude of stability and settlement problems associated with filling the site and applying the 1000 psf areal container load, 2) developing various alternatives for preconsolidating the site, utilizing conventional techniques (e.g., surcharging with wick drains), and 3) developing cost estimates for each preconsolidation alternative, in order to evaluate the economic viability of each.

1.3 FUTURE WORK

Our geotechnical exploration of the site, consisting of only 8 soil borings over the entire 100+ acres of Cell C, constitutes only a cursory study of the site subsurface conditions. A much more comprehensive geotechnical exploration and testing program will be required to develop final site preparation and structural design recommendations. In addition, this study does not address many geotechnical issues (e.g., dredge slope stability, wharf and land-side structure foundations, paving systems, etc.) which must be considered in the future. However, all of these analyses are dependent upon the method(s) and materials selected to preconsolidate the container yard. Furthermore, the variability of cost associated with each of these issues, and their combined impact on the economic feasibility of port construction at this site, are relatively small as compared to the cost of site preparation across the vast container yard. The cost estimates presented herein should be refined as unit costs for various fill sources are established, and prior to construction by additional site exploration.

2.0 SCOPE OF EXPLORATION

2.1 PREVIOUS SITE STUDIES

Prior to planning this study, Shiner Moseley and Associates provided us with information obtained during previous site subsurface explorations; specifically logs of borings commissioned by the USACOE in 1978 and 1987. Copies of these borings logs are enclosed in Appendix I. It appears these borings were performed to evaluate the subsurface conditions along the dikes surrounding the dredge disposal cells on Shoal Point. We used this earlier data to plan our boring locations and depths, with the realization that due to numerous past dredging cycles and dike raisings, subsurface conditions have probably been fairly dynamic over the past 20 years.

2.2 SCOPE OF FIELD EXPLORATION

We performed a total of eight Standard Penetration Testing (SPT) borings (designated C-1 through C-8) within Cell C. The boring locations are illustrated on the Soil Test Location Plan (Figure A-1), included in Appendix II. Boring locations were staked in the field by S&ME personnel, and then surveyed by a Shiner, Moseley and Associates subcontractor using a Global Positioning Satellite (GPS) system.

All field work was performed under the direct supervision of our field engineer. After drilling, the collected soil samples were sealed in air-tight containers and transported to our Mt. Pleasant, South Carolina laboratory.

2.2.1 Standard Penetration Test Borings

Within each of the eight soil test borings, split-spoon sampling and standard penetration testing (per ASTM Method D-1586) were generally performed at 5-ft intervals. This sampling method consists of mechanically drilling a borehole, and sampling the soil at selected depth intervals with a standard split-spoon device. The split-spoon is driven into the soil by a drop-weight hammer of specific weight, falling a specific height. The number of blows required to advance the sampler are recorded in 6-in. intervals over an 18-in. penetration. The SPT "N-value" is defined as the number of blows required to drive the sampler over the last two 6-in. intervals.

The resulting N-values provide an estimate of the soil's consistency, and are used with numerous correlations to estimate other in-situ soil characteristics. A mud-rotary drilling method was used to advance the borings. Boring termination depths ranged from 70 ft to 90 ft. A log of each boring is included in Appendix II, along with a soil profile that graphically presents the subsurface conditions.

2.2.2 Undisturbed Sampling

Within all of the SPT borings, "undisturbed" samples were also obtained by hydraulically pushing a 3-in. diameter, thin-walled sampler (a "Shelby Tube") into the soil. The Shelby Tube samples were either extruded in the field, classified, and subjected to field testing (pocket penetrometer or torvane), or sealed in wax and shipped to our laboratory for more specialized testing. Undisturbed sampling was performed in accordance with ASTM Method D-1587. A total of 10 "undisturbed" Shelby tube samples were obtained and shipped to our laboratory.

2.2.3 Pocket Penetrometer Tests

The pocket penetrometer is a relatively simple hand-held device used to roughly estimate the undrained shear strength of a soil sample. The penetrometer consists of a punch with a calibrated spring. The punch is pushed a certain distance into the soil sample and the calibrated spring measures the resulting resistance. The resistance is directly correlated to the unconfined compressive strength, which is twice the undrained shear strength. Undrained shear strength is a critical parameter in stability analyses. These tests were randomly performed on intact samples of cohesive soils. The pocket penetrometer results are listed on the boring logs in Appendix II.

2.2.4 Torvane Testing

The torvane is another relatively simple hand-held device used to estimate the undrained shear strength of a cohesive soil sample. The torvane consists of a vane and a vane driver with a calibrated spring. The vane driver, which has a dial gage at the end opposite of the vane, is set to zero. The vane is pushed into a reasonably flat soil sample, generally at least 2 in. in diameter, up to the depth of the blades. A constant vertical pressure is then applied while turning the knob

on the driver. A rate of rotation such that failure develops in 5 to 10 seconds is recommended. After failure develops, the spring tension is released and the index mark on the knob will indicate the maximum shear value. These tests were randomly performed on intact samples of cohesive soils. The torvane results are listed on the boring logs in Appendix II.

2.3 SCOPE OF LABORATORY TESTING

The primary focus of our laboratory testing program was to determine the soil properties required for our settlement analyses. As a secondary consideration, the laboratory test results were used to accurately classify the soils. The consolidation properties of the upper soft clay (dredge spoil and virgin deposits) are relatively unknown, and of prime interest. Therefore, our testing concentrated on these soils.

Our laboratory testing consisted of consolidation testing and various index property testing. Index testing consisted of grain size analyses (percent passing No. 200 sieve by weight), moisture content determinations, and Atterberg Limits tests. The results of the laboratory testing are summarized in the Soil Data Summary in Appendix III. Individual laboratory testing sheets are also included in Appendix III. All laboratory testing was performed in general accordance with ASTM or other industry standards.

2.3.1 INDEX TESTING

For the purpose of this report, index testing refers to laboratory tests that indicate soil characteristics which are independent of the in situ soil stresses. These tests were performed on split-spoon samples as well as "undisturbed" samples. The results of these tests are used for soil classification.

<u>Atterberg Limits Tests (ASTM D-4318)</u>. The Atterberg Limits test refers to a procedure to determine the Liquid Limit, Plastic Limit, and Plasticity Index of the soil. The Plastic Index and Liquid Limit are then used to determine soil classification. These tests both confirm our visual classifications and provide data for the consolidation potential of the soil. Eleven (11) Atterberg Limits tests were performed on select samples.

Grain Size Analysis and #200 Wash (ASTM D-1140). Grain size analyses were performed to determine the grain size distribution and percent of fines (by weight) of various soil samples. A wash #200 test determines the percent fines (i.e., silt and clay) portion only. These laboratory test data are primarily used to confirm our visual classifications, but can also be empirically related to the time dependant characteristics of the site soils. Five (5) grain size analyses and eleven (11) #200 wash tests were performed on select samples.

Natural Moisture Content Tests (ASTM D-2216). This is a routine laboratory test that determines the amount of water present in a soil sample in terms of its dry weight. The test data is used with empirical correlations to predict consolidation characteristics of the dredge spoil and soft virgin deposits. Forty five (45) natural moisture determinations were made on selected samples.

2.3.2 Undisturbed Sample Testing

These laboratory tests determine soil parameters that are dependent on the in situ soil conditions. Therefore, they were performed on "undisturbed" Shelby tube samples obtained from the cohesive, fine-grained dredge spoil and/or virgin deposits.

Unit Weight Tests. These tests were performed in order to determine the in situ dry unit weight of the soils, which is used in soil settlement analyses. Six (6) unit weight tests were included in our laboratory program.

Consolidation Tests (ASTM D-2435). A consolidation test consists of applying a series of loads to a 1-in. thick slice of an undisturbed sample, and measuring the amount of consolidation the sample undergoes at given time intervals for each load increment. The test results include the Compression Index (C_c), Compression Ratio (C'_c), Recompression Ratio, Void Ratio (e_o), Coefficient of Consolidation (C_v), and the Preconsolidation Pressure (P_c) of the sampled soil. These results are used to estimate both the magnitude and rate of potential due to given load. Six (6) consolidation tests were performed on select "undisturbed" samples.

3.0 SITE AND SUBSURFACE CONDITIONS

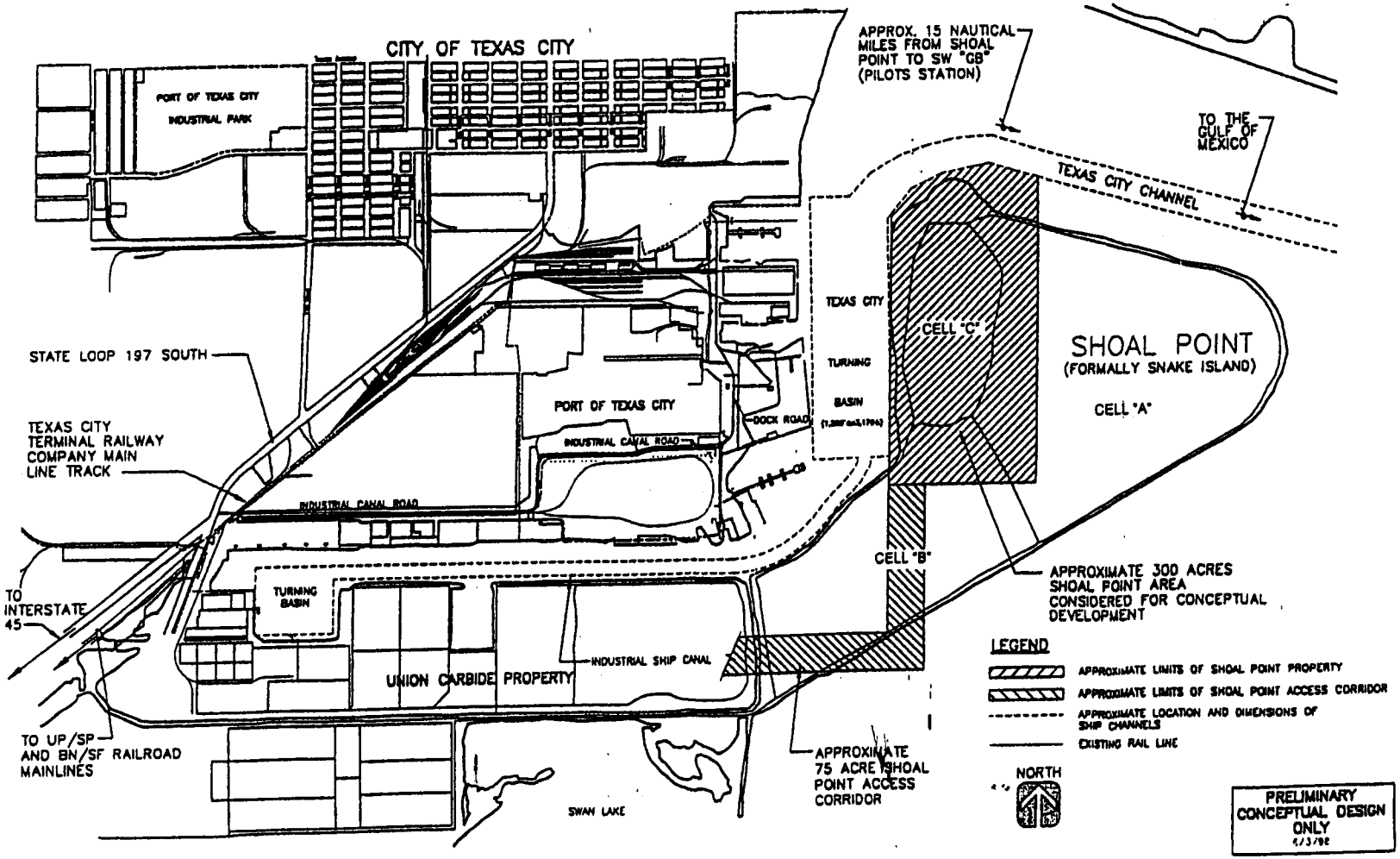
3.1 SITE DESCRIPTION

Shoal Point is a 500+ acre peninsula composed of three dredge disposal "cells" jutting into Galveston Bay, near Texas City, Texas. The site is located in a remote area off Loop 197, and can be accessed via an eroded causeway behind the Gulf Coast Waste Disposal Area. A plan of the site area is presented in Figure 2.

As defined by the cross-hatched areas in Figure 2, the conceptual design of the terminal dedicates approximately 300 acres of the site for terminal operations, and about 75 acres for a transportation corridor. The proposed terminal area includes portions of disposal Cells A and B, and all of Cell C. The majority of the transportation corridor is confined to Cell B.

Dredge disposal Cell C, which is the focus of this report, covers approximately 100 acres of the proposed 300-acre terminal area. Based on the topographical data provided by Shiner, Moseley & Associates, the elevation of the confining levy around Cell C varies between approximately 24.5 to 31.5 ft NAVD'88. However, the elevation is typically between 26 and 28 ft. Ground surface elevations at our boring locations, within the interior of Cell C, vary from approximately 15 to 26 ft NAVD'88. Based on our visual observations, it appears that the ground surface within Cell C is generally 5 to 10 ft higher than adjacent areas (Cells A & B).

The majority of Cell C is covered with dense vegetation; including tall grasses, young trees and thick bushes. Based on the amount of vegetation, the surface stability (i.e., the presence of a substantial "crust"), and the available literature, it appears that it has been a number of years since dredge spoil was last deposited in Cell C. At the time of our field exploration, no standing water was observed within Cell C. However, there was evidence (e.g., cattails, etc.) of a periodically wet, marshy area covering several acres. The site was easily accessed with a Failing 36 drill rig mounted on a rubber-tired ARDCO ATV carrier.



EXISTING SITE PLAN - TEXAS CITY AND SHOAL POINT

Do not use this plan for determination of distances or quantities. This plan is adapted from a conceptual plan by Vickerman Zachery Miller (a division of TanSystems Corporation).

Job No : 1131-99-588	S&ME	**Existing Site Plan** Proposed Shoal Point Container Terminal Texas City, Texas	Figure No : 2
Date: 8 November 1999			
Checked By: GJC			

3.2 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered by the field testing are shown on the Boring Logs and Subsurface Profile (Figure A-2), both included in Appendix II. The boring logs and profile represent our interpretation of the subsurface conditions based upon visual examination and laboratory testing of the gathered soil samples. Stratification lines on the boring logs and profile represent approximate boundaries between soil types; however, the actual transition may be gradual.

3.2.1 Subsurface Stratigraphy

The eight borings performed for this study initially encountered a 3 to 5-ft thick "crust" of hard, desiccated clay. This surficial crust is underlain by 20 to 35 ft of very soft to firm, relatively compressible clay. Although difficult to distinguish, it appears that at least 15 ft of this 20 to 35-ft thick zone of soft material is dredge spoil. The soft clay stratum is underlain by about 10 to 20 ft of sand, with relative densities ranging from medium dense to very dense, and then firm to very stiff clays and silts to termination of the borings at depths of 70 to 90 ft. Details pertaining to the thickness, consistency, strength, and other soil properties are indicated on the boring logs included in Appendix II.

3.2.2 Groundwater

At least 24 hours after drilling completion, water levels were measured within the boreholes at depths ranging from 5 to 12 ft below existing grade. It should be noted that the water levels will fluctuate during the year, due to such things as seasonal variations, tidal cycles, dredging cycles, and construction activity in the area.

4.0 GEOTECHNICAL TASK OVERVIEW

From a geotechnical standpoint, the rapid yet economical stabilization of the 20 to 35 ft of soft, compressible clay within Cell C is one of the main construction issues facing terminal development at Shoal Point. When design objectives and construction plans are refined, many other geotechnical issues will have to be addressed (e.g., pavement design, structure support, slope stability at boundaries, etc.). However, no other geotechnical issue will affect the cost and timing of construction like initial site stabilization. Consequently, the preliminary analyses presented in this report are focused on the stabilization issue.

4.1 SETTLEMENT AND CONSOLIDATION PRINCIPLES

When the stresses within a soil stratum increase (e.g., when a fill, pavement or container loads are placed on the surface), the individual soil particles are forced into a smaller volume that results in a reduction of the void space between the soil particles. If the void space is filled with water (i.e., when soils are below the water table), the reduction in void space initially results in an increase in pore pressure. For relatively free-draining soils such as sands, the pore pressures are quickly dissipated as the water flows out of the soil. As the water flows out, the soil compresses (voids are then smaller) and as a result, settlement occurs. Within clay, the movement of pore water is quite restricted and consequently, the pore pressure dissipation is much slower. Settlement, therefore, occurs over a much longer period.

The dissipation of excess pore pressure is termed consolidation, and the end of pore pressure dissipation is termed the end of *primary* consolidation. However, even after the excess pore pressure is fully dissipated, a soil will continue to compress due to a continued rearrangement of soil particles. This additional settlement is termed *secondary* consolidation or compression, and is generally much smaller than the settlement resulting from primary consolidation.

With regard to primary consolidation, the *magnitude* of the settlement is a function of the load and the soil's compressibility. The *rate* of the settlement is a function of the soil's compressibility, its permeability, and the distance the pore water must travel to a freely draining boundary. The drainage distance relationship is very important. For example, a drainage

distance of 10 will result in a settlement rate that is four times slower than the rate for a drainage distance of 5 (i.e., $10^2 = 100$ vs. $5^2 = 25$). Based on these principles, settlement mitigation for a given load is accomplished by either reinforcing the soil to reduce its compressibility, or preconsolidating the site by preloading with a soil surcharge or some other means (such as with a vacuum) to increase effective stresses within the soil mass. Methods to accelerate the dissipation of excess pore pressures, such as by the installation of wick drains, are typically used in conjunction with a preload. The basic principles of these settlement mitigation methods are as follows:

Reinforcement. By increasing the composite stiffness of a soil mass, settlement magnitudes can be reduced. The settlement reduction is a result of two related physical processes. The reinforcement reduces the overall compressibility of the deposit and the stiffer reinforced zones carry a greater percentage of the load, thereby reducing the load on the more compressible soil. Reinforcement is typically accomplished by installing stone columns or by using soil mixing to create lime-soil or soil-cement columns. However, in consideration of the size of the proposed development and the thickness of the compressible soil, soil reinforcement will probably be prohibitively expensive.

Surcharging. The post-construction compressibility of a soil deposit can be reduced by preconsolidating the stratum with a soil surcharge prior to construction. By the time the final loads are applied (or before settlement sensitive construction begins), the compressibility can be reduced such that subsequent loading will result in tolerable settlement. Surcharging is frequently used in conjunction with wick drains. The combination results in a much shorter surcharge period.

Wick Drains. The drainage distance is often reduced, thereby accelerating the settlement rate, by installing wick drains. The wick drains are installed in a grid pattern and typically fully penetrate the compressible layer. Depending on the wick spacing, consolidation times can typically be reduced by a factor of 4 to 10.

Based on our experience with similar sites and our knowledge of the relative costs of ground improvement options, we have restricted our analyses to preloading the site with a soil surcharge, in conjunction with the installation of wick drains. This is a common ground modification program used for settlement mitigation, and as such, is generally very economical. However, consideration of additional ground improvement options may be warranted after future refinement of terminal design details.

4.2 ANALYSIS DETAILS AND ASSUMPTIONS

4.2.1 Method of Analysis

Our settlement analyses were performed using UTCONSOL, a finite difference computer code published by the Geotechnical Engineering Center at the University of Texas at Austin. This powerful program has a great deal of flexibility. Some of the more salient features of the program are listed below:

- Drainage can be radial (e.g., towards wick drains), vertical, or both radial and vertical.
- Fill can be placed and/or removed instantaneously, in steps, or as a nonlinear function of time.
- Soil properties (e.g., compressibility and coefficient of consolidation) can vary with stress.
- Multiple layers of compressible soils can be considered.
- Groundwater can rise with fill placement, stay constant or fall, and corrections are made for buoyancy as fill is submerged.

4.2.2 Assumed Construction Details and Target Criteria

Due to the conceptual status of the proposed terminal design, our settlement analyses required numerous assumptions and approximations concerning finished grades, fill construction rates, surficial loading, tolerable surcharge times and tolerable post-construction settlement. The major assumptions used in our analyses are described below:

- We understand that the average final grade of the container yard within Cell C will probably be approximately 19 NAVD'88. Assuming that the pavement section will be about 1 ft thick, the average subgrade elevation beneath the pavement will be about 18 NAVD'88, which is the sole elevation criterion used in our analyses.

- We assumed that the surcharge would be left in place for either 1 or 2 years (from final surcharge fill placement to the start of surcharge removal). The actual construction time would obviously be much longer.

- We assumed that fill will be placed at an average rate of about 1/3 ft per day, and that the surcharge will be removed at an average rate of about 1 ft per day. (Although construction times calculated with these filling and stripping rates are only a small percentage of the surcharge time, these rates have a measurable influence in our analyses.)

- To allow for utility and pavement construction, we assumed that there will be a two-year period between the time surcharge removal ends and the time when live loading occurs.

- Based on the provided survey data, the average existing grade was assumed to be 18 NAVD'88, and the initial groundwater was assumed to be at a depth of 5 ft below the ground surface (elevation 13 NAVD'88). We also assumed that the groundwater will rise somewhat during surcharging, but never into the permanent fill and surcharge. For this assumption to be true, an extensive system of drains must be placed on the existing ground surface and maintained throughout the surcharge program. If the water is allowed to rise within the fill (or if the fill is allowed to sink into the water), the effective weight of the fill will be reduced and our current analyses will no longer be applicable.

- Live loads due to pavement weight and container loads were assumed to be 1150 psf (1 ft of PCC pavement plus four stacked containers).

- Our analyses have been performed for post-construction settlement criteria of 2 in., 3 in., 5 in., and 9 in. of primary consolidation. In other words, the surcharge is left in place until all but about 2 in., 3 in., 5 in., or 9 in. of primary consolidation settlement has occurred. Following the completion of the relatively short-term (<10 yrs) primary consolidation, $\leq$ 2 in. of secondary compression will probably occur over the long-term (10 to 50 yrs).

- Wick drain spacings of 3 ft, 5 ft, 7 ft, and 9 ft were evaluated. All analyses assumed that the wick drains were installed in a triangular grid arrangement.

4.2.3 Assumed Soil Profiles and Properties

After reviewing the field and laboratory test data we evaluated one simplified profile, consisting of 32 ft of very soft clay overlain by a 2-ft thick crust. Strata beneath 34 ft in depth were assumed to be relatively incompressible. Although relatively thin sand layers were encountered within some borings, the presence of sand layers was not considered in our analyses. Such

granular layers would reduce the magnitude of our estimated settlement, and increase the estimated settlement rate.

The laboratory consolidation test data from the dredge spoil and underlying virgin deposits were erratic. This can be expected within soils deposited in this manner. Therefore, except for distinguishing the upper two feet of "crust material" as being less compressible than the rest of the 34-ft layer, one set of soil properties was used for the entire compressible unit. These model soil properties are presented in Table 1.

TABLE 1 – SUMMARY OF SOIL PROPERTIES.

STRATA	COEFFICIENT OF CONSOLIDATION Cv (SQ. FT/DAY)	COEFFICIENT OF RADIAL CONSOLIDATION Cv_r (SQ. FT/DAY)	COMPRESSION INDEX C_c	RE-COMPRESSION RATIO C_c'	COORDINATES OF MODEL STRESS STRAIN CURVE (PSF, % STRAIN)	PERMEABILITY K (FT/DAY)
Crust (0'-2')	0.2	0.2	0.02	0.02	100, 1 8000, 4.8	5.0×10^{-3}
Spoil/Virgin soil (2'-34')	0.05	0.05	0.13	0.13	100, 1 8000, 26.1	3.0×10^{-5}

A moist unit weight of 115 pcf was used for the crust, spoil and soft virgin deposits in the upper 34 ft. The spoil and the virgin clay deposit were both assumed to be normally consolidated. The unit weight of all imported fill was also assumed to be 115 pcf.

4.2.4 Procedure

All analyses were performed using the same step-by-step procedure. The individual steps are described below.

1. Initially wick drains that fully penetrated the dredge spoil and upper soft clays were installed. Wick drains were spaced on 3 ft, 5 ft, 7 ft, or 9 ft centers in a triangular pattern.

2. Ninety days after wick drain placement, fill was placed to some elevation, Z, at a rate of about 1/3 ft/day. Elevation Z was varied for each run. As a starting point, elevation Z

was typically made equal to the existing ground surface elevation (18 NAVD'88) plus a fill thickness with a weight equal to the live loading (1150 psf).

3. The fill was left in place for 1 or 2 years, and then removed at a rate of about 1 ft/day until the fill elevation was equal to the target subgrade elevation of 18 NAVD'88.

4. After a 2-yr period with the fill at the target subgrade elevation, a live loading of 1150 psf was applied.

5. The settlement occurring as a result of the live loading was recorded and the process was repeated until an elevation Z was determined that resulted in a post-construction settlement within the criteria (i.e., 2 in., 3 in., 5 in. or 9 in.). As previously stated, this remaining settlement is only primary consolidation. One to two in. of post-construction secondary compression may also occur.

4.3 FILL DRAINAGE

To maintain the effectiveness of the surcharge, the groundwater must be prevented from rising within the fill. If the groundwater rises, fill becomes submerged and the resulting weight of the fill is reduced due to buoyancy. Consequently, a network of perforated plastic drainage pipes will have to be installed at the base of the fill. Our settlement analyses are based on the assumption that the groundwater is kept at the fill/existing material interface. In other words, the water table is assumed to drop as the site settles. It is very important that this condition be maintained during the entire surcharge period. Our subsequent cost estimates include an allowance of $1,500/acre for a gravity drainage system, to be installed within the initial 3 ft of site fill. This system would potentially consist of a network of perforated, plastic drainage piping; probably 4-in. to 6-in. diameter laterals and 18-in. to 24-in. trunk lines and collectors.

It is also important that the wick drains and drainage pipes be placed in a freely draining material (e.g., coarse sand). If the wick drains can not freely drain a significant "well resistance" may develop, which would greatly reduce the effectiveness of the wick drains. Depending on the type of material that is used for the bridge lift, strip drains may be needed to supplement the drainage system. However, no allowance for strip drains are included herein.

5.0 RESULTS OF SETTLEMENT ANALYSES

5.1 SUMMARY FIGURES

The results of our analyses are summarized numerically in Tables 2 and 3, and graphically in Figures 3 through 6. Within Table 2 the required surcharge elevations, corresponding fill thicknesses, and post-surcharge permanent fill thicknesses are listed for each of the four post-construction settlement criteria and four wick drain spacings, for a 1-yr surcharge time. Table 3 lists the same parameters for the 2-yr surcharge period.

Note that since the assumed average existing site grade is equal to the target subgrade elevation (18 NAVD'88), very little (<1 ft) of permanent fill will theoretically be left after stripping the surcharge. Although consolidated, the underlying clay would probably not provide a stable subgrade for the heavily loaded container yard pavement. Therefore, our subsequent cost estimates assume that: 1) after surcharging all spoil is undercut to elevation 15 NAVD'88, 2) the undercut surface is reinforced with a geosynthetic layer (i.e., geotextile of geogrid), and then 3) the undercut volume is replaced by backfilling over the geosynthetic layer with a portion of the stripped surcharge.

Within Figure 3, the required total fill thickness (or fill demand[4]) is plotted versus the wick spacing for each of the time/settlement criteria. The plotted fill quantity includes both the permanent fill and the temporary surcharge fill, which is the "Total Fill Thickness" listed in Tables 2 and 3. To determine the most economical combination of wick spacing and surcharge volume for a given surcharge time and post-construction settlement criteria we developed Figure 4, which illustrates the resultant per acre cost for each combination shown in Figure 3. The costs are based on the following assumed unit rates: permanent and surcharge fill at

[4] The fill demand is defined as the total amount of fill that is required to preconsolidate the site to the target subgrade elevation, with the given post-construction primary consolidation settlement, for a certain wick drain spacing. It roughly equals the amount of fill necessary to simulate the pavement and container loading, plus the amount of fill required to make up for the settlement induced by the surcharge.

TABLE 2 - SUMMARY OF SURCHARGE/WICK DRAIN OPTIONS FOR 1 YEAR SURCHARGE PERIOD

POST CONSTRUCTION SETTLEMENT (IN.)	WICK SPACING (FT)	REQUIRED SURCHARGE ELEVATION (FT-NAVD'88)	CORRESPONDING TOTAL FILL THICKNESS (FT)	RESULTING PERMANENT FILL THICKNESS[1] (FT)
9	3	21.75	3.80	0.18[2]
	5	22.00	4.04	0.21[2]
	7	22.25	4.29	0.21[2]
	9	22.50	4.54	0.21[2]
5	3	24.50	6.67	0.56[2]
	5	25.00	7.11	0.59[2]
	7	25.50	7.60	0.56[2]
	9	26.50	8.60	0.57[2]
3	3	26.00	8.25	0.74[2]
	5	26.50	8.65	0.76[2]
	7	27.50	9.63	0.75[2]
	9	28.50	10.63	0.73[2]
2	3	27.00	9.29	0.85[2]
	5	27.50	9.68	0.86[2]
	7	28.50	10.65	0.84[2]
	9	29.00	12.15	0.84[2]

[1] This is the thickness of fill remaining after the surcharge is removed to elevation 18 NAVD'88.

[2] To establish a minimum desired permanent fill thickness of 3 ft, the thin fill layers in these areas will have to be removed, the underlying spoil undercut, and then the undercut areas backfilled with the striped fill. A geosynthetic layer will probably be needed to reinforce the bottoms of the undercut areas. These undercutting, subgrade reinforcement and backfilling costs are included in all of our cost estimates.

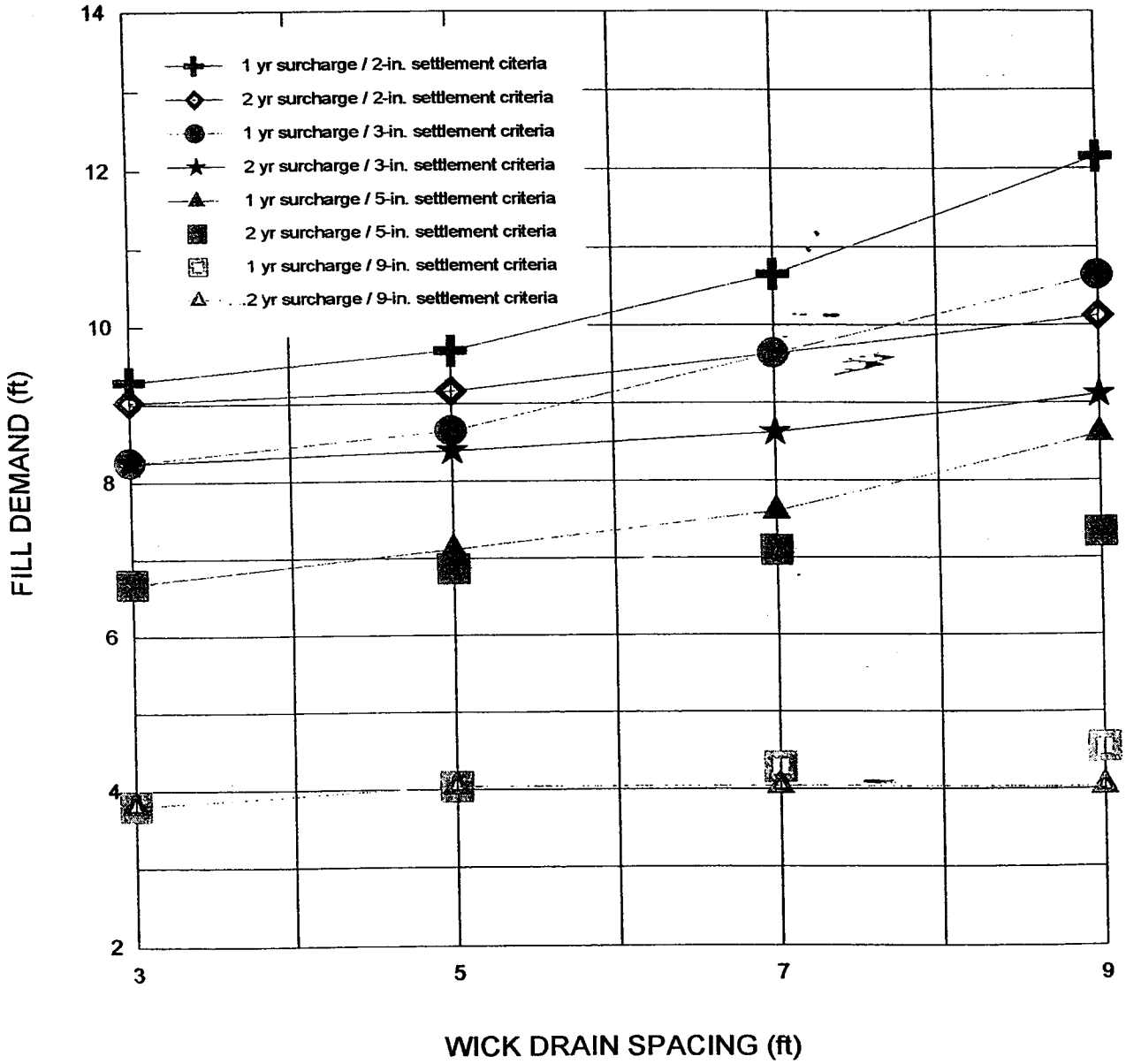
TABLE 3 - SUMMARY OF SURCHARGE/WICK DRAIN OPTIONS FOR 2 YEAR SURCHARGE PERIOD

Post Construction Settlement (in.)	Wick Spacing (Ft)	Required Surcharge Elevation (Ft-NAVD'88)	Corresponding Total Fill Thickness (Ft)	Resulting Permanent Fill Thickness[1] (Ft)
9	3	21.75	3.80	0.18[2]
	5	22.00	4.04	0.22[2]
	7	22.00	4.04	0.21[2]
	9	22.00	4.03	0.19[2]
5	3	24.50	6.67	0.56[2]
	5	24.75	6.86	0.58[2]
	7	25.00	7.09	0.59[2]
	9	25.25	7.33	0.57[2]
3	3	26.00	8.25	0.74[2]
	5	26.25	8.39	0.76[2]
	7	26.50	8.62	0.75[2]
	9	27.00	9.11	0.75[2]
2	3	26.75	9.03	0.83[2]
	5	27.00	9.16	0.84[2]
	7	27.50	9.63	0.85[2]
	9	28.00	10.12	0.84[2]

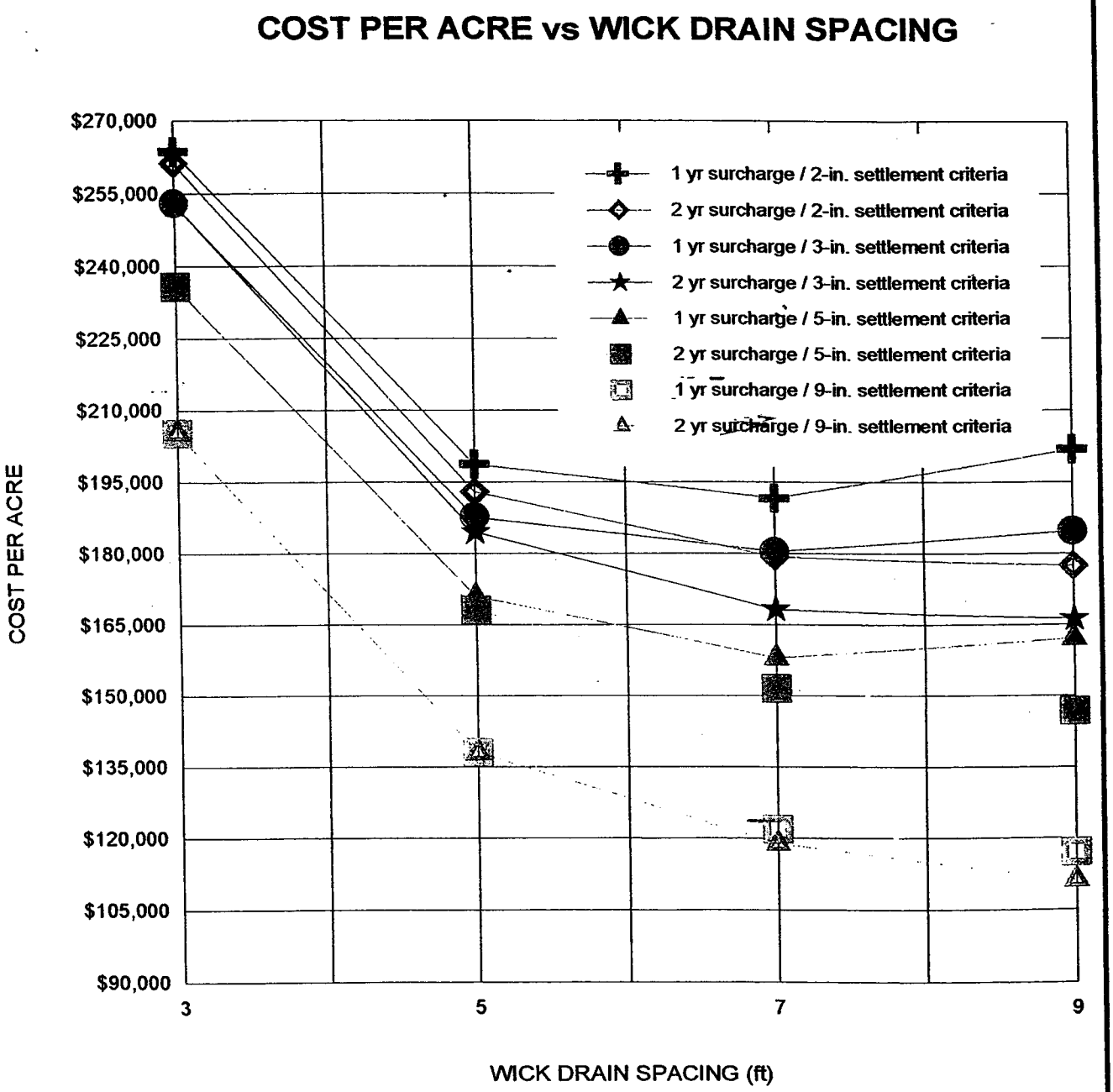
1 This is the thickness of fill remaining after the surcharge is removed to elevation 18 NAVD'88.

2 To establish a minimum desired permanent fill thickness of 3 ft, the thin fill layers in these areas will have to be removed, the underlying spoil undercut, and then the undercut areas backfilled with the striped fill. A geosynthetic layer will probably be needed to reinforce the bottoms of the undercut areas. These undercutting, subgrade reinforcement and backfilling costs are included in all of our cost estimates.

FILL DEMAND vs WICK SPACING

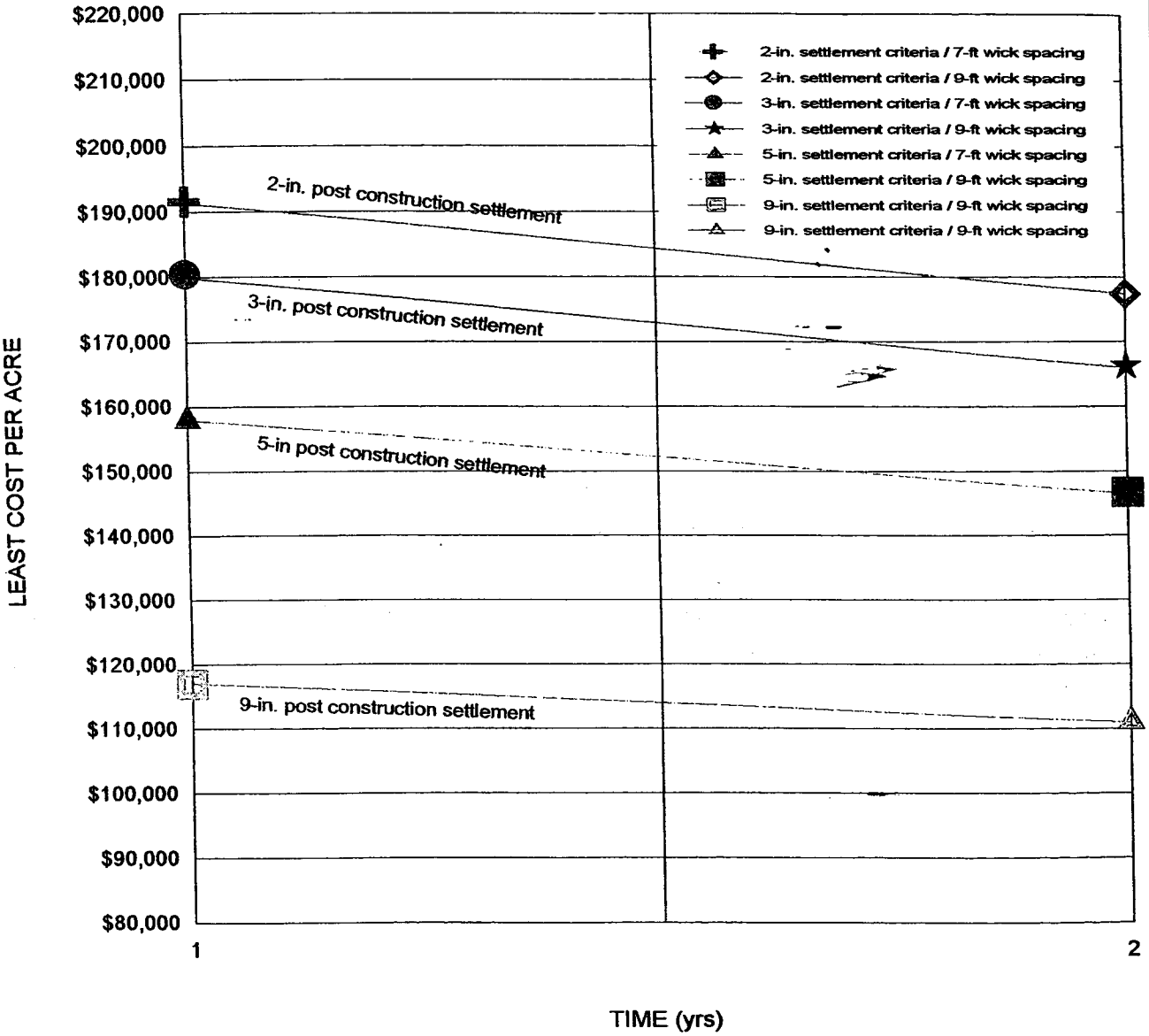


Job No : 1131-99-588 Date: November 8, 1999	S&ME	**FILL DEMAND vs WICK SPACING** Proposed Shoal Point Container Terminal Texas City, Texas	Figure No: 3



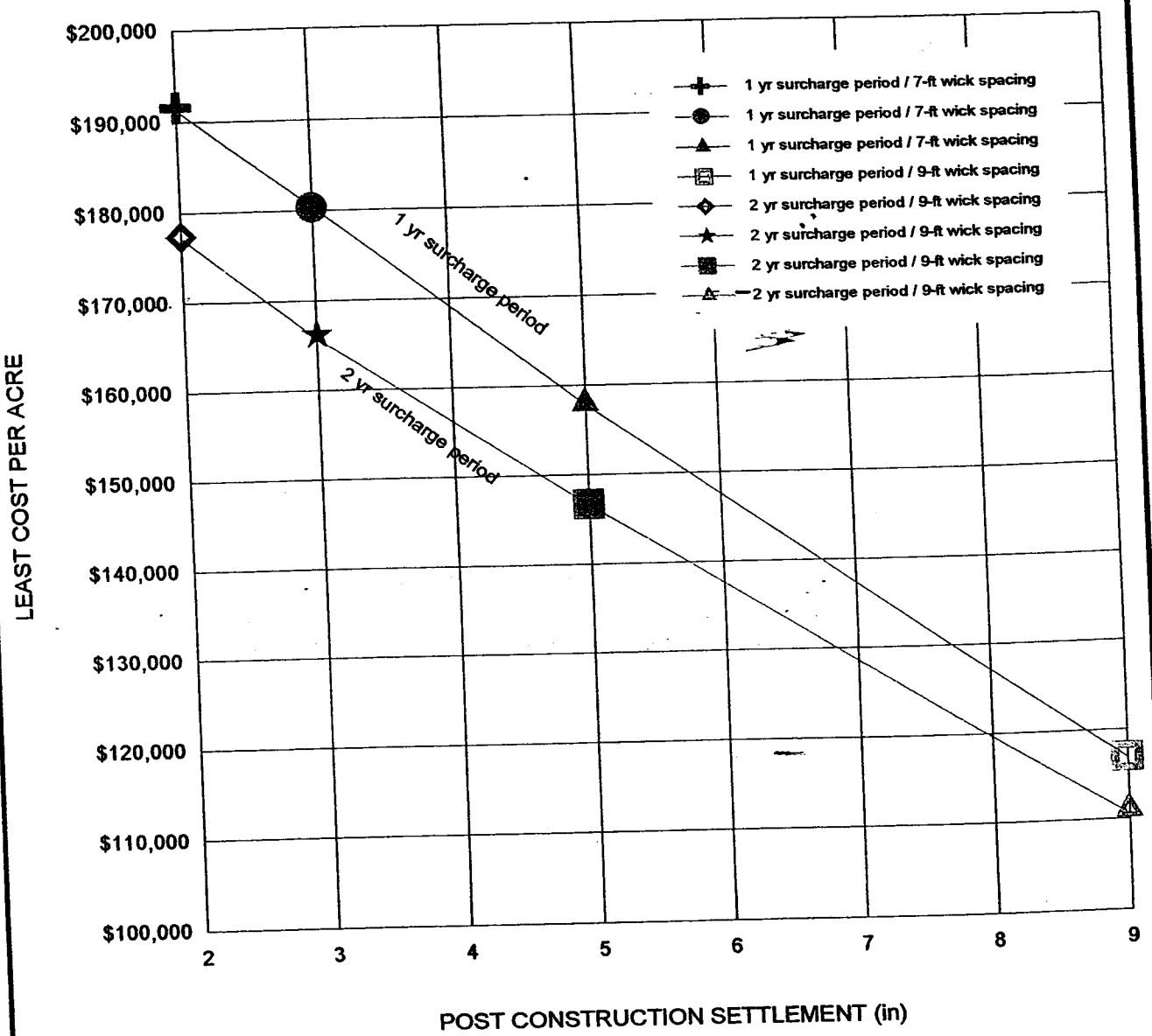
Job No : 1131-99-588 Date: November 8, 1999	S&ME	**Cost Per Acre vs Wick Spacing** Proposed Shoal Point Container Terminal Texas City, Texas	Figure No: 4

LEAST COST PER ACRE vs TIME



Job No : 1131-99-588 Date: November 8, 1999	S&ME	**Least Cost Per Acre vs Time** Proposed Shoal Point Container Terminal Texas City, Texas	Figure No: 5

LEAST COST PER ACRE vs POST CONSTRUCTION SETTLEMENT



Job No : 1131-99-588 Date: November 8, 1999	S&ME	**Least Cost Per Acre vs Settlement** Proposed Shoal Point Container Terminal Texas City, Texas	Figure No: 6

$6.00/CY, surcharge removal at $1.50/CY, undercutting and disposal of spoil at $2.00/CY, undercutting and replacement of permanent fill at $2.50/CY, $2.50/SY for the geosynthetic layer, $1,500/acre for the drainage system, and installed wick drains at $0.50/LF. Tallies for the costs in Figure 4 are included in Appendix IV. Figure 5 illustrates how the "least costs" from Figure 3 vary with surcharge time. Figure 6 illustrates how the "least costs" from Figure 3 vary with post-construction settlement

Although site development plans may be based on a given surcharge period, we understand that construction schedules may unexpectedly require the surcharge to be removed prematurely. Therefore, for each soil profile, we have plotted settlement vs. time for the most economical combination of wick drain spacing and surcharge height. These figures are labeled A-3 through A-10 in Appendix V. The effects of early surcharge removal can be evaluated by determining the amount of settlement remaining at the time of surcharge removal. As an example, consider Figure A-7 with a hypothetical premature surcharge removal at 485 days instead of the plotted 2 yr surcharge. At 485 days, the predicted settlement is about 8.25 in. The predicted ultimate settlement is 11.9 in. (which occurs after the container loading is applied). Therefore, as a result of the early surcharge removal, post-construction settlement should be about 3.7 in. (i.e., 11.9 in. minus 8.25 in.). This 3.7 in. of post-construction settlement is almost double the original planned criterion of 2 in. In this example, reducing the surcharge time by half, effectively doubles the post-construction settlement.

5.2 SECONDARY COMPRESSION

Secondary compression was not directly considered in our settlement criterion, but secondary compression may occur. Secondary compression is defined as a re-arrangement of the soil particles (or creep) after primary consolidation is complete. We estimate that an additional 1 to 2 in. of settlement will occur within the first 50 years of terminal operations, as a result of secondary compression. The magnitude of secondary compression will be proportional to the thickness of the underlying soft clay stratum. The consequences of this settlement, especially with regard to pavement design should be more fully addressed after objectives are better defined.

6.0 CONSTRUCTION ISSUES

6.1 STABILITY AND BEARING CAPACITY DURING CONSTRUCTION

The soft clay and spoil deposits are weak, and bearing capacity failures (i.e., mudwaving) may occur if the fill is placed too quickly. Due to the apparent thickness of the crust, we do not anticipate that this will be a major concern. But if stability problems arise during construction, the construction sequence will have to be controlled such that fill is placed in stages across the site rather, than rapidly within one area. Considering the effect of the wick drains, we expect the soft clays to gain strength relatively quickly and the staging, if necessary, should not be a lengthy process.

We did not perform any borings within the dikes during our subsurface exploration. Therefore we cannot perform any slope stability analysis at this juncture. The placement of the required surcharge fill immediately behind the existing dike is not expected to cause a massive rotational failure. However, as surcharge heights and construction sequences are better defined, subsequent subsurface investigations should be catered to evaluate this stability issue.

6.2 INSTRUMENTATION AND CONSTRUCTION MONITORING

Prediction of settlement magnitudes and rates is always difficult. The typical process begins with the performance of laboratory consolidation tests on small (i.e., 1-in thick by 3-in. diameter) discrete samples. The laboratory procedure is assumed to sufficiently model the actual loading conditions, and the test results are assumed to be representative of the natural deposit. However, soil is non-homogenous and there are always variations in the soil properties (both measured and actual) on a site. Such variations are magnified when a large site like Cell C (100 acres) is evaluated on a global basis (i.e., with widely spaced borings across the entire site). Therefore, thorough instrumentation of the spoil mass will be needed to evaluate the effectiveness of the surcharge, and thereby determine when the surcharge may be removed.

Instrumentation must be installed to measure surface settlement, settlement at various points within the soil profile, pore pressures, and water table heights. Inclinometers will also be

necessary to help prevent slope stability failures. Although such instrumentation programs are relatively expensive, the results are necessary to evaluate the effectiveness of the initial surcharge program, as well as to establish better parameters for future development of the spoil basins and to quantify in-place fill for contractual purposes.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on these preliminary analyses and assumptions, our conclusions are as follows:

- The site can be effectively pre-consolidated by the conventional approach of surcharging with an embankment of fill, in conjunction with wick drains to accelerate the consolidation process. For the surcharge times considered (1 to 2 years), no other ground remediation technique is anticipated to be more economical.

- As illustrated in Figure 4, our analyses indicate that relatively wide (i.e., > 5 ft) wick drain spacings and large surcharge heights are the more economical alternative, regardless of the allowed surcharge time or specified settlement criterion. However, these trends would change with an increase in fill cost, making the tighter wick spacings more economical.

- For an assumed surcharge period of 1 year, fill demands for the most economical surcharge and wick drain combinations range from about 7300 cy/acre for the 9-in. post-construction settlement criterion, to about 17,200 cy/acre for the 2-in. settlement criterion. The estimated ground subsidence which would be induced by these surcharge volumes ranges from about 2½ to 10 in. By lengthening the allowed surcharge time to 2 years, the fill demand is reduced to about 6500 cy/acre to 15,500 cy/acre, for the same settlement criteria as above. Settlements caused by the lesser surcharge volumes over the longer surcharge period are the same.

- As illustrated in Figure 5, lengthening the allowed surcharge time from 1 to 2 years has relatively little effect on our estimated site preparation costs. The estimated savings are less than 9% for each post-construction settlement option.

- Figure 6 indicates that the selected post-construction settlement criterion will have the greatest effect on site preparation costs. For both of the assumed surcharged times, estimated site preparation costs for the 9-in settlement criterion are only about 62% of estimated site preparation costs for the 2-in. criterion.

- Overall, subsurface conditions across Shoal Point are considerably better than conditions we have encountered at other major container terminal sites of similar history (i.e., old dredge disposal areas) in the Charleston, South Carolina and Savannah, Georgia areas. For the same post-construction performance criteria, our analyses indicate that site preparation costs for a Shoal Point container terminal should be less than half those we have calculated for a major new terminal site (Daniel Island) in Charleston. Therefore, we certainly conclude that the Shoal Point site can be preconsolidated and ready for construction after one to two years , and that the cost of such site preparation should not be a major cost factor in determining the economic feasibility of developing a container terminal at the site.

We note that all of the costs we cite herein include costs for large quantities of temporary fill (i.e., the surcharge) which can be used to develop future container yard areas. No salvage value for this material was subtracted from our costs. Consideration of salvage values will make wider wick spacings and greater surcharge volumes more economical than those identified by these analyses.

With regard to future work for Cell C, these conventional preloading options may need to be refined once construction plans and cost of fill sources are better defined, and after a more comprehensive subsurface exploration program is performed. In addition, the use of more innovative techniques such as vacuum induced consolidation may be advantageous if fill costs are substantially higher than assumed herein. Finally, details of the site drainage system need to be developed, the instrumentation plan must be created, and slope stability along the surcharge perimeter should be investigated.

APPENDIX I

PREVIOUS SITE STUDIES

AUGUST 1978 GALVESTON DISTRICT CORPS OF ENGINEERS

SEPTEMBER 4, 1987 McCLELLAND ENGINEERS
FIELD INVESTIGATION FOR GALVESTON DISTRICT CORPS OF ENGINEERS

SEPTEMBER 14, 1987 McCLELLAND ENGINEERS
FIELD INVESTIGATION FOR GALVESTON DISTRICT CORPS OF ENGINEERS

CORPS OF ENGINEERS

U. S. ARMY

GALVESTON DISTRICT LABORATORY

GALVESTON, TEXAS

[illegible] 197[illegible]

REPORT OF SOIL TESTS
TEXAS CITY INDUSTRIAL CHANNEL
RETAINING LEVEE ON SNAKE ISLAND
BORING NO. 78-250 through 261

GDLR NO. 1632

1. AUTHORITY: Test request dated 4 August 1978 and oral request on 6 October 1978 from Mr. V. E. Bennett, Chief, Soils Design Section, Foundation and Materials Branch, requested the Galveston District Laboratory to conduct tests in accordance with the requirements of applicable test procedures shown in paragraph 2.

2. TEST METHODS: Tests were conducted in accordance with the following procedures:

TEST REQUIRED	TEST PROCEDURE
Unit Weight	EM 1110-2-1906,Appendix II,30 Nov 1970
Moisture Content	EM 1110-2-1906,Appendix I,30 Nov 1970
Soil Classification	MIL STD, 619-B, 12 June 1968
Liquid and Plastic Limits	EM 1110-2-1906,Appendix III,30 Nov 1970
Sieve Analysis	EM 1110-2-1906,Appendix V,30 Nov 1970
Soil Consistency	Based on procedure outlined in EM 1110-345-147,using pocket penetrometer tests (Soiltest Model CL-700)for clays
Linear Shrinkage(Bar Method)	Paving Manual,4th Edition,Galveston District,Engineering Division,Foundation and Paving Section,Method 326,Page 252

TEXAS CITY INDUSTRIAL CHANNEL
RETAINING LEVEE ON SNAKE ISLAND
GDLR NO. 1632

3. PRESENTATION OF DATA:

a. Results of tests are shown on the inclosed twelve test data summary sheets.

b. Unconfined compression tests results are presented in Table 1.

c. The applied compressive stress versus axial strain relationship is presented in Plates XI-2-1 through XI-2-6.

d. Drawing showing location of borings is inclosed.

4. COMMENTS: Portions of samples not consumed in testing are in storage at the Galveston District Laboratory in the event additional testing is required.

THOMAS

DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGCEN.

GDLR 1632

REFERENCE OR OFFICE SYMBOL	SUBJECT
SWGED-FS	Texas City Industrial Channel - Levees on Snake Island - Exploration and Testing for Levee Design

TO Chief, Geology Sec
Chief, Matls & Testing Sec

FROM SWGED-FS

DATE 4 Aug 78

CMT 1 Bennett/hl/353

1. Attached are two copies of a boring layout showing the locations and depths of borings 78-250 thru 78-261 to be drilled for the subject project. The purpose of the borings is for use in foundation design for the subject drainage structure. The Chief of the Geology Section should assist the drill crew in locating the boring from visual observations.

2. A stake should be left at each boring location after the boring have been completed. The Chief, Survey Branch, should then be notified in order that the coordinates and the top of the ground elevation can be determined for each boring.

3. The borings shall be drilled to the depths indicated on the layout and shall be 3-inch diameter undisturbed borings. Sampling shall be continuous.

4. All samples shall be visually classified in the field. Pocket penetrometer readings are to be made on all samples. Water table measurements should be taken and recorded for each boring.

5. Special testing of samples will be requested after the field logs of the borings have been reviewed.

6. Charges for the work should be made to BE007304J20K000.

BENNETT

1 Incl
Boring Layout (dupe)

DA FORM 2496 REPLACES DD FORM 96, WHICH IS OBSOLETE.

DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGCEN.

EDLR 1632

REFERENCE OR OFFICE SYMBOL: SWGED-FS

SUBJECT: Texas City Industrial Channel - Retaining Levees on Snake Island - Staking of Boring Locations for Foundation Exploration

DATE 4 Aug 78

TO// THRU Chief, Engrg Div FROM SWGED-F

Bennett/hl/353

TO Chief, Survey Br

1. Two copies of a boring layout showing the locations of borings 78-250 thru 78-261 to be drilled for the subject project are attached.

2. The drill crew will locate and drill the borings and leave a stake at each boring location. The Chief, Geology Section, will notify the Chief, Survey Branch, when the borings have been completed. It is requested that the coordinates and top of ground elevation be determined and furnished the Foundations and Materials Branch.

3. Charges for the work should be made to BE007304J20K000.

POWLEDGE

1 Incl
Boring layout (dupe)

CF:
Chief, Geology Section

Information Copy

DA FORM 2496 REPLACES OD FORM 46, WHICH IS OBSOLETE.

GDLR NO. 1632

BORING NO. 78-250

DATE COMPLETED

17 July 1971

PROJECT: TEXAS CITY INDUSTRIAL CHANNEL

TEST DATA SUMMARY

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 4.9	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY P. c. f.	L.L.	P.L.	Lab Sample No.	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
													75		0	4	96	50	0	0	1	2
C	0.0	2.5	Brown clay with random 0.0-12.5	0.95	CH	M	0.75		30	90	53	17	2787					1				
			sand seams	0.9		ST	1.00		27	94			2788									
C	2.5	5.0	Gray & brown clay with random sand seams	1.0		M	0.50		39	*			2789									
C	5.0	7.5	Gray & brown clay with random sand seams	0.95		ST	1.00		36	88			2790									
C	7.5	10.0	Brown clay	0.9		M	0.50		38	*	56	18	2791		0	6	94	50	0	0	0	3
C	10.0	12.5	Gray & brown clay	0.9	CL	VS	0.0	–	36	87			2792									
C	12.5	15.0	Gray sandy clay 12.5-25.0	1.0		S	0.25	–	31	95			2793									
C	15.0	17.5	Brown & gray clay	0.85		M	0.50		26	99	29	19	2794		0	2	98	50	0	0	0	1
C	17.5	20.0	Brown clay	0.8		M	0.50		27	100			2795									
C	20.0	22.5	Brown & gray clay	0.9		ST	1.00		26	100			2796									
C	22.5	25.0	Brown & gray clay																			

24 hour water reading: 2.0'

*Disturbed

-10

BORING NO. 78-250

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Cutler Formal Sampler
(3) Percent Passing

GDLR NO 1632

BORING NO. 78-251

12 July 1971

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

DATE COMPLETED

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 5.5	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No. 78	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
1C	0.0	2.5	Brown sandy clay with wax impregnated 0.0 - 2.5	0.3	CL		dist.		No	Test			2850									
2C	2.5	5.0	Brown clay with random sand seams 2.5 - 15.0	1.05	CH	M	0.75		35	87	62	17	2851		0	0	100	50	0	0	0	0
3C	5.0	7.5	Brown clay with random sand seams	1.1		ST	1.0		34	88			2852									
4C	7.5	10.0	Gray & brown clay with random sand seams	1.0		ST	1.25		36	87			2853									
5C	10.0	12.5	Gray & brown clay with random sand seams	1.0		ST	1.25		34	89			2854									
6C	12.5	15.0	Gray & brown clay with random calcareous	1.05		M	0.50		38	86	60	18	2855		0	2	98	50	0	0	0	1
7C	15.0	17.5	Brown clay 15.0 - 25.0	0.85	CL	S	0.25	-	27	98	33	16	2856		8	2	90	50	4	4	5	5
8C	17.5	20.0	Brown clay with random clay seams	1.00		M	0.50		29	93			2857	8	0	0	100	50	0	0	0	0
9C	20.0	22.5	Brown clay	0.80		VST	2.00		27	100	31	14	2858		0	0	100	50	0	0	0	0
0C	22.5	25.0	Brown clay	0.95		S	0.25	-	27	98			2859									

24 hour reading (water) -3.8'

#information obtained from driller's log

-7

20

-15

BORING NO. 78-251

CONSISTENCY — CONTINUE ROUTE

CONSISTENCY — CONSISTENCY ROUTE

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler
(3) ... Wt. Rtnd / Init. Wt. x 100 = % Rtnd.

Form [illegible]
12 July 1971

GDLR NO. 1632

BORING NO. 78-252

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

DATE COMPLETED

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 1.7	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No. 78	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
C	0.0	2.5	Brown sandy clay with 0.0 - 5.0 random sand seams	1.0	CL	ST	1.75		22	*	46	14	2860		0	16	84	50	0	0	1	8
C	2.5	5.0	Brown sandy clay with random sand seams	0.8		ST	1.50		27	95			2861									
C	5.0	7.5	Gray clay with random sand seams 5.0 - 7.5	0.90	CH	VS	0.0	-	76	*	89	26	2862		0	0	100	50	0	0	0	0
C	7.5	10.0	Gray clay with random sand seams 7.5 - 23.2	0.90	CL	VS	0.0		53	*	49	16	2863		0	14	86	50	0	0	0	7
C	10.0	12.5	Brown clay	0.80		M	0.50		48	*			2864									
C	12.5	15.0	Brown clay	0.80		VS	0.00		28	96	33	17	2865		2	6	92	50	1	2	3	4
C	15.0	17.5	Brown clay with one inch silt layer	0.80		ST	1.50		24	100	44	19	2866		0	0	100	50	0	0	0	0
C	17.5	20.0	Brown clay with random sand layers	0.90		M	0.75		26	97			2867	9	0	8	92	50	0	0	1	4
C	20.0	22.5	Brown clay with random sand layers	0.85		M	0.75		20	106			2868									
C	22.5	25.0	Gray & brown clay with 23.2 - 25.0 2" silt layer at top	1.15	CH	ST	1.00		33	90	65	21	2869		0	0	100	50	0	0	0	0

24 hour water reading (taken from driller's log)
-1.9'

*Disturbed

BORING NO. 78-252

CONSISTENCY — [illegible]

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler

GDLR NO. 1632

BORING NO. 78-253

DATE COMPLETED

12 July 1971

PROJECT: TEXAS CITY , TEXAS

TEST DATA SUMMARY

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 11.2	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No.	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
													2797									
1C	0.0	2.5	Gray & brown clay with 0.0-12.5 random sand seams	0.75	CH	VST	3.00		26	*			2798		0	2	98	50	0	0	0	1
2C	2.5	5.0	Gray & brown clay with random sand seams	1.05		M	0.75		40	80	68	23	2799									
3C	5.0	7.5	Gray & brown clay with random sand seams	1.0		ST	1.25		42	78			2800									
4C	7.5	10.0	Gray & brown clay with random sand seams	0.6		ST	1.00		38	85			2801		2	8	90	50	1	2	2	5
5C	10.0	12.5	Gray clay with random sand seams	1.0		S	0.25		58	69	68	17	2802		0	44	56	50	0	0	0	22
6C	12.5	15.0	Gray sandy clay with 12.5-15.0 random sand seams	1.0	CL	ST	1.00		26	96	32	19	2803		0	4	96	50	0	0	0	2
7C	15.0	17.5	Gray & brown clay with 15.0-20.0 random sand seams	1.1	CH	M	0.50		33	91	46	23	2804									
8C	17.5	20.0	Gray & brown clay with 2" sand layer at bottom	0.95		VS	0.0		28	94			2805									
9C	20.0	22.5	Gray sandy clay with 20.0-25.0 random shell fragments	0.9	CL	VS	0.0		36	85			2806		0	36	64	50	0	0	1	18
10C	22.5	25.0	Gray sandy clay with random shell fragments	1.0		VS	0.0		39	84	48	15										

*Disturbed

KEY: CONSISTENCY — COHESIVE SOILS: VS S M ST VST H Very Soft Soft Medium Stiff Very Stiff Hard

CONSISTENCY — COHESIVELESS SOILS: VL L M D VD Very Loose Loose Medium Dense Very Dense

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler
(3) Acc. Wt. Rtnd / Init. Wt. x 100 = % Rtnd.

BORING NO. 78-253

Sheet 1 of sheets 1

GDLR NO 1632

BORING NO. 78-254

DATE COMPLETED

1: July 1971

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 8.2	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY P. c. f.	L.L.	P.L.	Lab Sample No.	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
1C	0.0	2.5	Brown clay with random sand seams 0.0-10.0	0.9	CH	VST	2.25		32	91			2816									
2C	2.5	5.0	Brown clay with random sand seams	0.95		ST	1.50		25	*			2817									
3C	5.0	7.5	Gray & brown clay with random sand seams	0.9		ST	1.00		44	78	67	19	2818		0	2	98	50	0	0	0	1
4C	7.5	10.0	Gray & brown clay with random sand seams;sand pocket at bottom of sample	1.9		ST	1.25		46	77			2819									
5C	10.0	12.5	Gray & brown sandy clay 10.0-12.5	1.0	CL	M	0.75		40	84	41	16	2820		0	22	78	50	0	0	0	11
6C	12.5	15.0	Gray & brown clay 12.5-17.5	1.05	CH	VS	0.0		64	*	57	27	2821		2	10	88	50	1	1	2	6
7C	15.0	17.5	Gray & brown clay	1.0		VS	0.0		58	65			2822		+	+						
8C	17.5	20.0	Gray gravelly clayey sand with numerous shell fragments 17.5-20.0	1.05	SC	VS	0.0		32	89	49	14	2823		25	41	34	625	160	257	327	415
9C	20.0	22.5	Gray clay with few shell fragments 20.0-25.0	1.1	CL	VS	0.0		48	*			2824									
10C	22.5	25.0	Brown clay with random calcareous nodules	0.7		ST	1.00		26	100	41	18	2825		4	2	94	50	2	2	3	3
			#WATER READING: 48 hour reading -5.3											+	Shell							

*Disturbed

#Information obtained from driller's log

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BORING NO. 78-254

CONSISTENCY — COHESIVE SOILS: VS, S, M, St, VST, H

CONSISTENCY — COHESIONLESS SOILS: Vl, L, M, D, VD — Loose, Medium Dense, Very Dense

(1) Tons/S.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler
(3) Acc. Wt. Rtnd i Init. Wt. x 100 , % Rtnd.

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[illegible] Form 207
12 July 1971

GDLR NO. 1632

BORING NO. 78-255

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

DATE COMPLETED

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 8.9	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No. 78	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
C	0.0	2.5	Brown sandy clay with random sand seams 0.0-22.5	0.75	CL	M	0.50		26	98			2870					1				
C	2.5	5.0	Brown sandy clay with random sand seams	0.95		M	0.50		25	98			2871									
C	5.0	7.5	Brown clay with random sand seams	0.9		M	0.50		26	99	39	15	2872		2	12	86	50	1	2	3	7
	7.5	10.0	# no recovery						34				2873									
J	10.0	12.5	Brown clay with shells						39				2874									
J	12.5	17.5	Brown clay with random shell fragments #wash sample						42		40	18	2875		6	18	76	50	3	3	3	12
J	17.5	20.0	Gray sandy clay						41				2876									
J	20.0	22.5	Gray sandy clay		SP SM		dist.		20				2877	1	0	92	8	50	0	0	0	46
C	22.5	25.0	Gray silty sand- Disturbed 22.5-25.0						63	65			2878									
C	25.0	27.5	Gray sandy clay with shell fragments 25.0-30.0	0.95	CL	S	0.25		29	*	43	13	2879		0	34	66	50	0	2	3	17
C	27.5	30.0	Gray sandy clay with random sand seams	1.1		VS	0.0		37		27	14	2880		10	58	32	602	62	165	206	410
J	30.0	38.5	Gray gravelly silty sand with numerous shell fragments (#wash sample) 30.0-38.5		SM				39	82	74	18	2881		0	0	100	50	0	0	0	0
C	38.5	40.0	Brownish gray clay 38.5-40.0	1.05	CH	M	0.75															

#Information obtained from driller's log

*Disturbed

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler

BORING NO. 78-255

GDLR NO 1632

BORING NO. 78-256

17 July 1971

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

DATE COMPLETED

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 15.8	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No. 78	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
1C	0.0	2.5	Brown clay with random 0.0 - 12.5 silt seams	0.8	CL	S	0.25		29	92			2807									
2C	2.5	5.0	Brown clay with random silt seams	1.05		ST	1.50		40	*	33	20	2808		0	4	96	50	0	0	0	2
3C	5.0	7.5	Brownish gray clay with random silt seams & organic seams	0.9		S	0.25		25	97			2809									
4C	7.5	10.0	Brownish gray clay with random silt and organic seams	0.95		VS	0.0		28	*			2810									
5C	10.0	12.5	Brownish gray clay	1.0		VS	0.0		46	*	27	16	2811		0	8	92	50	0	0	0	4
6C	12.5	15.0	Brownish gray sandy silt 12.5-15.0 with random clay layers	0.85	ML	VS	0.0		41	*			2812	2	0	20	80	50	0	0	0	10
7J	15.0	20.0	Brownish gray sandy 15.0 - 20.0 clay with shell fragments		CL				44		47	14	2813		2	26	72	50	1	3	4	14
	20.0	22.5	# no recovery																			
C	22.5	25.0	Gray & brown silty 22.5 - 25.0 sand with shell fragments	0.7	SM				22	102			2814	1	0	82	18	50	0	0	0	41
J	25.0	30.0	Tan silty sand 25.0 - 30.0		SP SM				24				2815	0	0	90	10	50	0	0	0	45

#information obtained from driller's log

*Disturbed

BORING NO. 78-256

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler
(3) Acc. Wt. Rtnd (Init. Wt. x 100) % Rtnd.

KEY: CONSISTENCY — COHESIVE SOILS: VS S M ST VST H Very Soft Soft Med. Stiff Very Stiff Hard

CONSISTENCY — COHESIVE SOILS: VL L M D VD Very Loose Loose Medium Dense Very Dense

12 July 1971

GDLR NO. 1632

BORING NO. 78-257

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

DATE COMPLETED

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 11.6	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No. 78	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
C	0.0	2.5	Brown clay with random 0.0-5.0 sand seams	0.8	CH	ST	1.00		27	78			2826									
C	2.5	5.0	Brown clay with random sand seams	0.9		M	0.50		29	97	55	18	2827		0	2	98	50	0	0	0	1
C	5.0	7.5	Brown sandy silt 5.0-12.5	0.9	ML	M	0.50		21	*			2828	1	0	18	82	50	0	0	0	9
J	7.5	10.0	Brown sandy silt						27				2829	1	0	38	62	50	0	0	0	19
C	10.0	12.5	Gray & brown sandy silt	0.85		VS	0.0		24	*			2830	2	0	40	60	50	0	0	0	20
C	12.5	15.0	Brownish gray clay with 12.5-15.0 random silt seams	0.95	CH	M	0.50		61	*	58	16	2831		0	2	98	50	0	0	0	1
C	15.0	17.5	Brownish gray sandy 15.0-17.5 silt	0.7	ML	M	0.50		21	*			2832	1	0	24	76	50	0	0	0	12
	17.5	20.0	# no recovery																			
C	20.0	22.5	Gray sandy clay with 20.0-27.5 random shell fragments	0.85	CL	VS	0.0		39	83			2833									
C	22.5	25.0	Gray sandy clay with random shell fragments	1.0		VS	0.0		42	79	42	13	2834		0	24	76	50	0	0	0	12
C	25.0	27.5	Gray sandy clay with random shell fragments	0.95		VS	0.0		37	83			2835									
C	27.5	30.0	Gray silty sand with 27.5-30.0 random shell fragments	0.95	SM	VS	0.0		23	102			2836	1	0	78	22	50	0	0	0	39
J	30.0	36.5	Gray silty sand 30.0-36.5		SP SM				26				2837	0	0	92	8	50	0	0	0	46
C	36.5	40.0	Grayish brown clay 36.5-40.0	1.1	CH	ST	1.25		40	82	74	21	2838		0	2	98	50	0	0	0	1

#HOLE CAVED IN AT 3.0'

-25

#information obtained from driller' log

* Disturbed

CONSISTENCY — COHESIVE SOILS: VS S M SF VST H — Very Loose Loose Medium Dense Very Dense

CONSISTENCY — COMPRESSIVE SOILS: VL L M H VH

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler
(3) Acc. Wt. Rtnd (Init. Wt. x 100) % Rtnd.

BORING NO. 78-257

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Form 207
12 July 1971

GDLR NO 1632

BORING NO. 78-258

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

DATE COMPLETED

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 11.9	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No. 78	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
1J	0.0	2.5	Brown sandy clay with random sand seams 0.0-25.0		CL				18				2882									
2J	2.5	5.0	Brown sandy clay with random sand seams						25				2883									
3C	5.0	7.5	Brown clay with random sand seams and pockets	0.9		S	0.25		28	95	39	14	2884		0	12	88	50	0	1	2	6
4C	7.5	10.0	Brown clay with random sand seams	0.75		VS	0.0		41	*			2885									
5C	10.0	12.5	Gray clay	1.0		VS	0.0		42	75			2886									
6C	12.5	15.0	Gray clay	0.9		VS	0.0		37	*	36	16	2887		0	12	88	50	0	0	0	6
7J	15.0	17.5	Gray clay						75				2888									
8C	17.5	20.0	Gray clay	1.1		VS	0.0		50	*			2889									
9C	20.0	22.5	Gray sandy clay with random sand seams	1.0		VS	0.0		40	81			2890									
10C	22.5	25.0	Gray sandy clay with random sand seams & shell fragments	0.8		VS	0.0		38	80	42	13	2891		0	34	66	50	0	0	0	17
	25.0	27.0	#no recovery (same as above)																			
1J	27.0	35.5	Gray silty sand 27.0-35.5		SM				30				2892	0	0	80	20	50	0	0	0	40
2C	35.5	37.5	Gray & brown clay 35.5-40.0	1.1	CH	M	0.75		43	*			2893		0	2	98					
3C	37.5	40.0	Brown clay	1.1		ST	1.25		37	85	75	22	2894		0	2	98	50	0	0	0	1

WATER READING AT 24 hr: -5.9'

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#information obtained from driller's log
*Disturbed

BORING NO. 78-258

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler
(3) Acc. Wt. Rtnd / Init. Wt. x 100 = % Rtnd.

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Form 261
12 July 1971

GDLR NO. 1632

BORING NO. 78-259

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

DATE COMPLETED

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	Sample Depth, Feet To	CLASSIFICATION ELEVATION TOP BORING 9.2	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No. 78	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
1C	0.0	2.5	Brown clay with random 0.0-10.0	0.8	CL	M	0.75		29	94			2895									
			sand seams																			
2C	2.5	5.0	Brown clay with random sand seams	0.6		ST	1.00		30	93			2896									
3C	5.0	7.5	Brown clay with random sand seams	0.95		S	0.25		28	96	43	14	2897		0	10	90	50	0	1	2	5
5C	7.5	10.0	Gray sandy clay with random sand	1.0		VS	0.0		29	*	29	17	2898		0	44	56	50	0	0	0	22
			seams																			
5C	10.0	12.5	Gray silty sand 10.0-12.5	0.8	SM	VS	0.0		24	*			2899	.2	0	62	38	50	0	0	0	31
5C	12.5	15.0	Gray sandy clay with 12.5-20.0	0.95	CL	VS	0.0		38	*			2900									
			random sand seams																			
7C	15.0	17.5	Gray sandy clay with random sand	0.9		VS	0.0		43	*			2901									
			seams																			
8C	17.5	20.0	Gray sandy clay with random sand	1.05		VS	0.0		30	*	31	16	2902		0	46	54	50	0	0	0	23
			seams																			
	20.0	22.5	# no recovery (sand)																			
9C	22.5	25.0	Brown clay 22.5-25.0	1.05	CH	ST	1.50		33	89	64	25	2903		0	2	98	50	0	0	0	1
0C	25.0	27.5	Brown sandy silt with 25.0-27.5	1.0	ML	M	0.75		23	102			2904	2	0	36	64	50	0	0	0	18
			random clay layers																			
1C	27.5	30.0	Brown & gray clay with 27.5-30.0	0.95	CL	M	0.50		25	101	33	17	2905		0	2	98	50	0	0	0	1
			2" sand layer at bottom																			
2C	30.0	32.5	Brown & gray clay 30.0-40.0	1.15	CH	ST	1.50		40	82			2906									
3C	32.5	35.0	Brown & gray clay	1.0		M	0.75		41	80			2907									
4C	35.0	37.5	Brown & gray clay	1.1		ST	1.25		35	87	46	24	2908		0	2	98	50	0	0	1	1
5C	37.5	40.0	Brown & gray clay	1.1		ST	1.75		32	92			2909									

#information obtained from driller's log
*Disturbed

-13

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler

BORING NO. 78-259

GWG Form 207
12 July 1971

GDLR NO 1632

BORING NO. 78-260

PROJECT: TEXAS CITY, TEXAS

TEST DATA SUMMARY

DATE COMPLETED

LOCATION: SNAKE ISLAND

FIELD NO.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 15.3	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No. 78	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
C	0.0	2.5	Brown clay with random 0.0-12.5 sand pockets	0.95	CH	ST	1.00		22	*			2910									
C	2.5	5.0	Brown clay with random sand seams	0.8		ST	1.25		28	97	51	14	2911		0	6	94	50	0	1	1	3
C	5.0	7.5	Brown clay with random sand seams	0.8		ST	1.00		28	96			2912									
C	7.5	10.0	Brown clay with random sand seams	1.05		M	0.75		26	99			2913	21	0	0	8	50	0	0	1	4
C	10.0	12.5	Brown clay with random sand seams	1.05		ST	1.25		27	98	51	19	2914		0	4	96	50	0	0	0	2
C	12.5	15.0	Gray & brown clay with 12.5-20.0 random sand seams	0.65	CL	M	0.50		27	*			2915									
C	15.0	17.5	Brown clay with random sand seams	1.1		VS	0.0		43	75	43	18	2916		0	10	90	50	0	0	0	5
C	17.5	20.0	Brown clay with random sand seams; 2" sand layer at bottom	1.0		VS	0.0		55	*			2917									
C	20.0	22.5	Gray & brown clay with 20.0-22.5 random sand seams	1.0	CH	VS	0.00		51	67	38	23	2918		0	10	90	50	0	0	0	5
C	22.5	25.0	Gray sandy clay 22.5-30.0	0.95	CL	VS	0.00		30	93	37	16	2919		0	44	56	50	0	0	0	22
C	25.0	27.5	Brown sandy clay with 2" clay layer at top	1.10		S	0.25		25	99	30	15	2920		0	26	74	50	0	0	0	13
C	27.5	30.0	Brown clay	0.90		ST	1.25		21	*	1		2921									
J	30.0	35.5	Brown silty sand (#wash sample) 30.0-35.5		SM				22				2922	0	0	66	34	50	0	0	0	33
C	35.5	37.5	Brown clay 35.5-37.5	1.15	CL	VST	2.75		26	100	39	18	2923		0	0	100	50	0	0	0	0
C	37.5	40.0	Brown clay with random 37.5-40.0 silt seams	1.00	CH	ST	1.50		35	89	50	20	2924		0	0	100	50	0	0	0	0

#information obtained from driller's log
*Disturbed

-12

BORING NO. 78-260

CONSISTENCY — COMPRESSIVE SOILS

(1) Tons/sq.ft. Unconfined Compressive Strength
(2) Split Barrel Sampler

[illegible] Form 207
12 July 1971

PROJECT: TEXAS CITY, TEXAS

LOCATION: SNAKE ISLAND

TEST DATA SUMMARY

ORDER NO. 1632

BORING NO. 78-261

DATE COMPLETED

Field No.	Sample Depth, Feet From	To	CLASSIFICATION ELEVATION TOP BORING 5.2	Length of sample recv'd	SYMBOL	CONSISTENCY	POCKET (1) PENETROMETER	STAN. PENET. BLOWS/FT (2)	MOISTURE CONTENT %	DRY DENSITY p. c. f.	L.L.	P.L.	Lab Sample No.	BAR L.S.	SIEVE ANALYSIS PERCENT GRVL	SAND	FINES	INIT. WT.	ACC. WT. RTND. SIEVE NO. (3) NO. 4	NO. 10	NO. 40	NO. 200
C	0.0	2.5	Brown & gray clay with random sand seams 0.0 - 20.0	0.75	CL	ST	1.50		25	98			2839									
C	2.5	5.0	Brown & gray clay with random sand seams	0.9		M	0.75		24	*			2840									
C	5.0	7.5	Brown & gray clay with random sand seams	1.0		S	0.25		27	*	45	15	2841		2	6	92	50	1	1	2	4
C	7.5	10.0	Gray clay with random sand seams	1.1		VS	0.0		32	88	44	15	2842		0	12	88	50	0	0	0	6
	10.0	12.5	# no recovery																			
C	12.5	15.0	Brownish gray sandy clay	0.9		VS	0.0		29	98			2843									
C	15.0	17.5	Gray to brown sandy clay with random shell fragments	0.95		VS	0.0		35	*			2844									
C	17.5	20.0	Brown gravelly clay with random silt seams & calcareous nodules	0.9		ST	1.25		20	107	31	16	2845		10	14	76	50	5	9	11	12
C	20.0	22.5	Brown silty sand 20.0 - 25.0	1.0	SM	ST	1.75		17	111			2846									
C	22.5	25.0	Brown silty sand	0.85		M	0.50		19	111			2847	0	0	58	42	50	0	0	0	29
C	25.0	27.5	Brown clay with random sand seams 25.0 - 30.0	0.95	CL	ST	1.00		26	98			2848									
C	27.5	30.0	Brown clay with random sand seams	0.85		VST	2.25		21	108	39	14	2849		0	6	94	50	0	0	0	3

24 hour water reading: 4.0'

-12

#information obtained from driller's log
*Disturbed

BORING NO. 78-261

(1) Tons/Sq.Ft. Unconfined Compressive Strength
(2) Split Barrel Sampler
(3) Acc. Wt. Rtnd (Init. Wt. x 100) % Rtnd.

McClelland engineers

Report No. 0187-0512-1
September 4, 1987

Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Attention: Mr. David Campbell
Geotechnical and Surveys

Field Investigation
Delivery Order No. 0019
Snake Island Disposal Area
Texas City, Texas

This report presents the results of our field investigation for the Snake Island Disposal Area in Texas City, Texas. This work was conducted in accordance with Contract DACW64-87-D-0001 and as requested by your Delivery Order No. 0019 dated August 19, 1987.

Field Investigation

We explored subsurface soil conditions by drilling two 3-in. continuous sample borings at the site. The borings were drilled to 25-ft depth using wet-rotary drilling techniques. Total footage drilled for this study was 50 ft. Drilling and sampling was performed in accordance with specifications outlined in your Contract No. DACW64-87-D-0001. The boring locations were staked by Corps of Engineers personnel prior to our investigation, and the approximate locations are shown on Plate 1.

Boring Logs

Detailed descriptions of the soils encountered in each boring are presented on the boring logs on Plates 2 and 3. Plate 4 presents a key to classification terms and symbols used on the logs. The boring logs also present soil conditions, torvane and direct penetrometer readings, and related drilling information. The "Symbol" column on the logs indicates the sample number and type (Q-quart or J-jar). Quart samples are 12 in. long unless noted at bottom of log. Sample depth is indicated as the bottom of sample. Penetrometer readings were multiplied by 0.6 to compute the undrained shear strength in kips per square foot and the undrained shear strength was then plotted on the boring logs.

P.O. Box 740010, Houston, Texas 77274, (713) 772-3700, Telex: 762447

Variations in Subsurface Conditions

Data concerning subsurface conditions have been obtained at boring locations only. Actual soil conditions at locations between borings may differ from those presented on our boring logs. The soil stratigraphy described on the boring logs is based on interpretations of our technician's and driller's observations during drilling and classification of soil samples. The boundaries between soil layers are approximate and transitions between soil types may be gradual.

Conclusion

The following illustrations are attached and complete this report:

Plate 1	Plan of Borings
Plates 2 and 3	Logs of Borings
Plate 4	Terms and Symbols Used on Boring Logs

We have enjoyed working with The Corps of Engineers on this project. Please call if you have any questions about the information presented here.

Sincerely,

McCLELLAND ENGINEERS, INC.

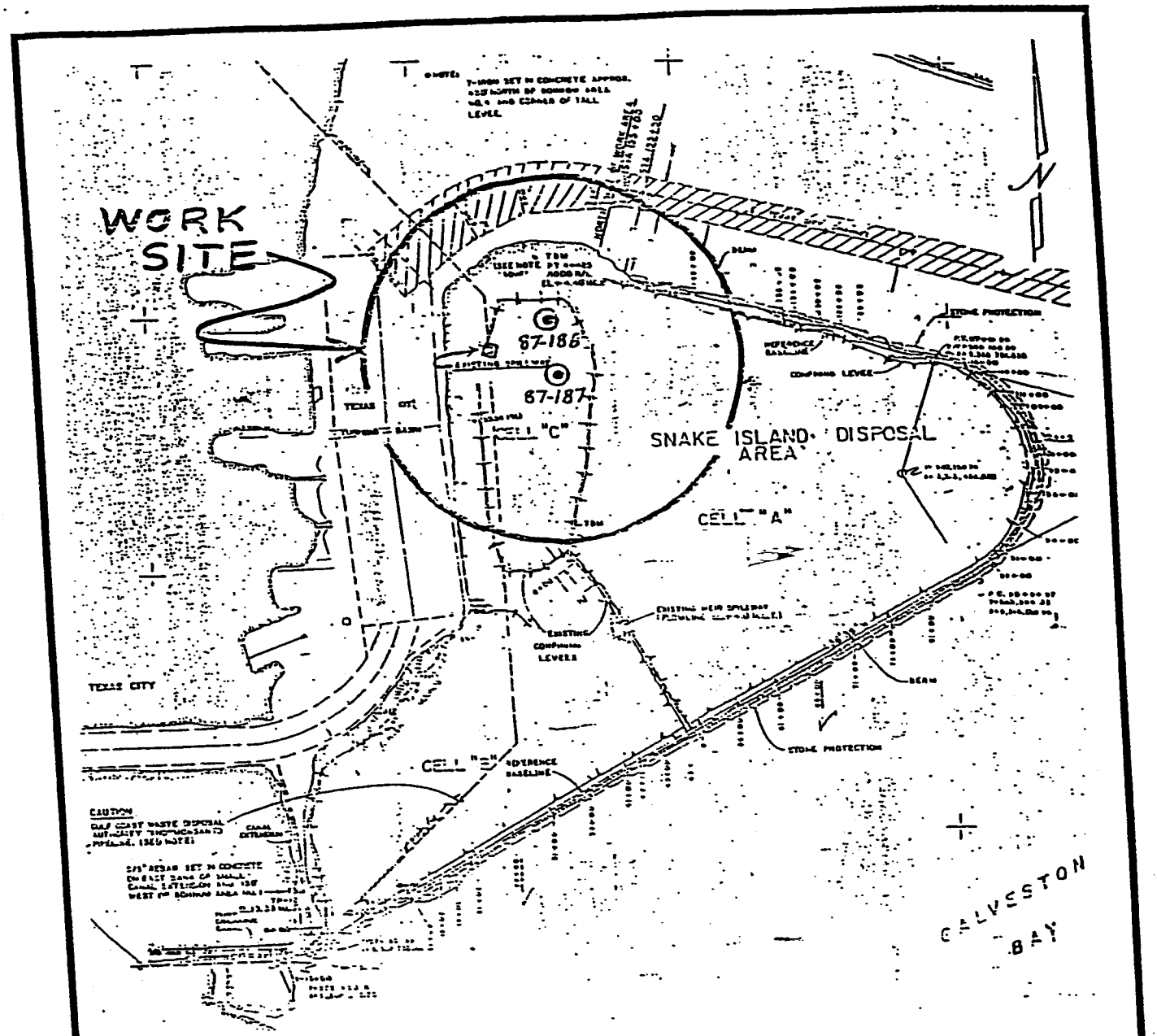
Pamela G. Anderson

Pamela G. Anderson
Geotechnical Engineer

Patricia M. Peters

Patricia M. Peters, P.E.
Project Supervisor

PGA/PMP/(8,108:547)
Copies Submitted: (2)



PLAN OF BORINGS

(Not to Scale)

PLATE I

McCLELLAND

LOG OF BORING NO. 87-186

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

SURFACE EL

DEPTH, FT.	SYMBOL	SAMPLES	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	PENETROMETER
	1Q					2.0
	2Q					
	3Q					1.6
5	4Q					1.0
	5Q					1.3
10	6Q					1.2
	7Q					1.3
	8Q					1.0
15	9Q					2.1
	10Q					1.3
20	11Q					2.1
	12Q					1.5
	13Q					1.0
25	14Q					1.0
30						
35						
40						
45						
50						

FILL: CLAY, firm, brown and gray
- stiff, brown, weathered and cracked to 1.5'
- with sand pockets below 2'
- with sand seams, 8' to 10' and below 18'
- stiff, 14' to 16', and 18' to 20'
- with shell fragments below 22'

(25')

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

WATER CONTENT, %: Plastic Limit — Natural — Liquid Limit; 20, 40, 60

UNDRAINED SHEAR STRENGTH: KIPS PER SQ FT 0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125

JOB NO.: 0187-0512
COMPLETION DEPTH: 25 ft.
DATE: August 28, 1987
DEPTH TO WATER IN BORING:
CAVED AT:
DATE:

SAMPLER: 3-in. Thin-walled Tube

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 2

LOG OF BORING NO. 87-187

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

SURFACE EL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION
	1S		FILL: CLAY, firm, brown and gray with silt pockets
	2Q		- very stiff and brown to 1'
	3S		- dark gray, 1' to 3'
	4S		- soft, 1' to 2'
5	4		- very soft, 2' to 6'
			- tan, 3' to 6'
	5Q		- with sand pockets and seams below 6'
10	6Q		
	7Q		
	8Q		
15	9Q		
	10Q		
20	11Q		
	12Q		
25	13Q		- gray, with sand layer below 24.5' (25')

* Tube pulled off sample during recovery.

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

DEPTH, FT	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit — Natural — Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH, KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5) / KILOPASCALS (25, 50, 75, 100, 125)	PENETROMETER, tsf
5						1.0
10						1.6
						1.5
						1.5
15						1.4
						1.2
						1.2
20						1.6

JOB NO.: 0187-0512
COMPLETION DEPTH: 25 ft.
DATE: August 28, 1987
DEPTH TO WATER IN BORING:
CAVED AT:
DATE:

SAMPLER: 3-in. Thin-walled Tube

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

PLATE 3

McCLELLAND ENGINEERS

McClelland engineers

Report No. 0187-0508-1
September 14, 1987

Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Attention: Mr. David Campbell
Geotechnical and Surveys

Field Investigation
Delivery Order No. 15
Snake Island Disposal Area
Texas City, Texas

This report presents the results of our field investigation for the Snake Island Disposal Area in Texas City, Texas. This work was conducted in accordance with Contract DACW64-87-D-0001 and as requested by your Delivery Order No. 0015 dated July 13, 1987.

Field Investigation

We explored subsurface soil conditions by drilling 18 sample borings at the site. The borings were drilled to between 30- and 110-ft depth using wet-rotary drilling techniques. Total footage drilled for this study was 1110 ft. Drilling and sampling was performed in accordance with specifications outlined in your Contract No. DACW64-87-D-0001. The boring locations were staked by Corps of Engineers personnel prior to our investigation, and the approximate locations are shown on Plate 1.

Boring Logs

Detailed descriptions of the soils encountered in each boring are presented on the boring logs on Plates 2 through 19. Plate 20 presents a key to classification terms and symbols used on the logs. The boring logs also present soil conditions, torvane and direct penetrometer readings, and related drilling information. The "Symbol" column on the logs indicates the sample number and type (Q-quart or J-jar). Quart samples are 12 in. long unless noted at bottom of log. Sample depth is indicated as the bottom of sample. Penetrometer readings were multiplied by 0.6 to compute the undrained shear strength in kips per square foot and the undrained shear strength was then plotted on the boring logs.

Variations in Subsurface Conditions

Data concerning subsurface conditions have been obtained at boring locations only. Actual soil conditions at locations between borings may differ from those presented on our boring logs. The soil stratigraphy described on the boring logs is based on interpretations of our technician's and driller's

observations during drilling and classification of soil samples. The boundaries between soil layers are approximate and transitions between soil types may be gradual.

Conclusion

The following illustrations are attached and complete this report:

Plate 1	Plan of Borings
Plates 2 through 19	Logs of Borings
Plate 20 missing	Terms and Symbols Used on Boring Logs

We have enjoyed working with The Corps of Engineers on this project. Please call if you have any questions about the information presented here.

Sincerely,

McCLELLAND ENGINEERS, INC.

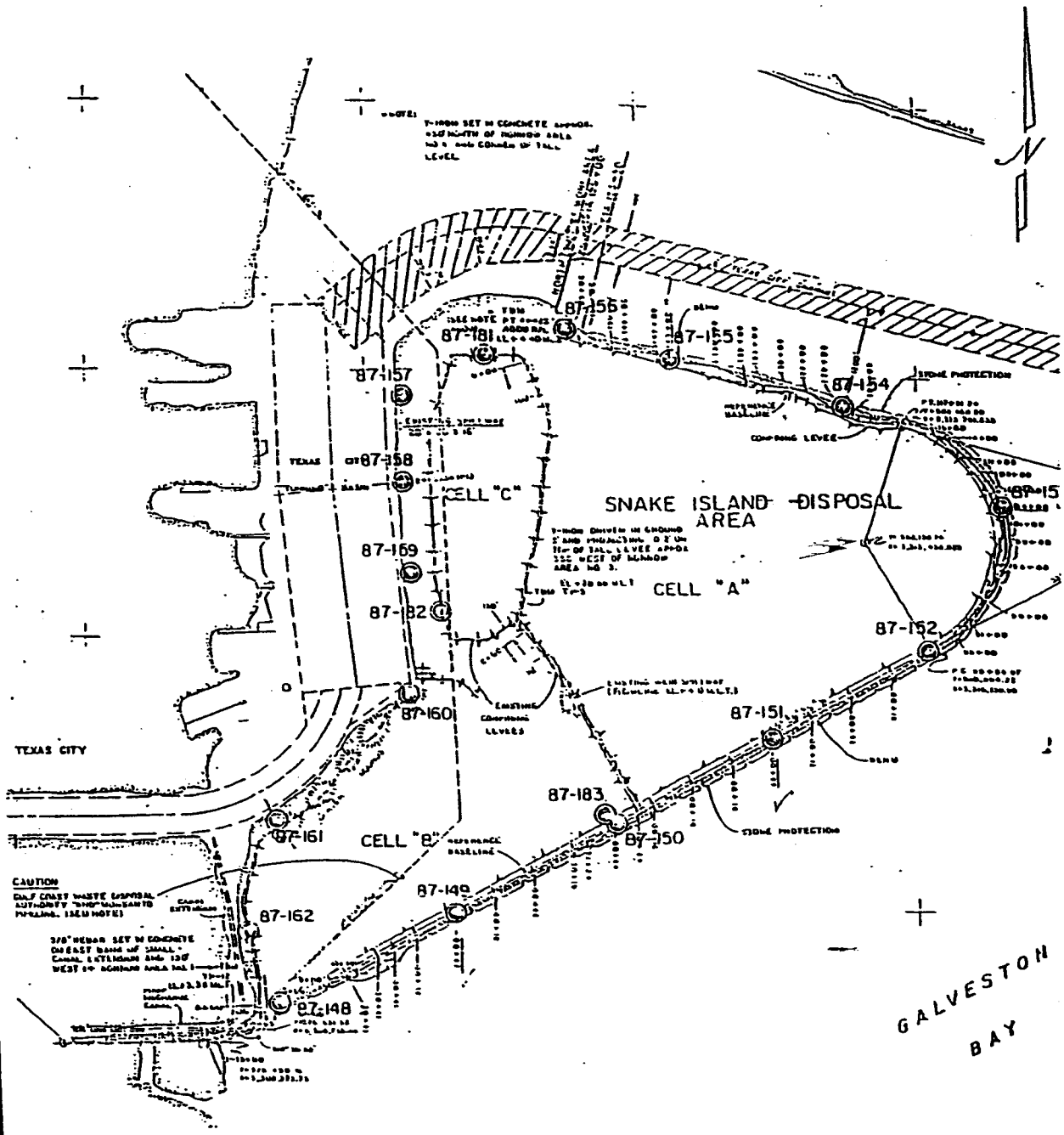
Celia Hayes for

Pamela G. Anderson
Geotechnical Engineer

Patricia M. Peters

Patricia M. Peters, P.E.
Project Supervisor

PGA/PMP/(8,108:553)
Copies Submitted: (2)



PLAN OF BORINGS

(Not to Scale)

McCLELLAND ENGINEERS

PLATE 1

LOG OF BORING NO. 87-148

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT. LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH, KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125)	PENETROMETER
		1Q	FILL: CLAY, Firm brown and gray -stiff to 3'						2.5
		2Q							1.4
5		3Q	-brown below 4'						1.7
		4Q							1.4
		5Q	-soft below 8' (10')						0.7
10		6Q	SANDY CLAY, Stiff, gray, with shell fragments and sand seams						2.2
		7Q							
15		8Q	-brown and gray below 14'						2.8
		9Q							3.0
		* 11Q	-very stiff below 18' (20.5')						4.2
20		10Q	CLAY, stiff, brown, slickensided -with sandy clay pockets to 24'						2.2
		12Q							1.8
25		13Q	- firm, 24' to 26'						1.6
		14Q							1.7
30		15Q	(30')						2.1
35									
40									
45									
50									

* Two attempts to recover sample. Sample highly disturbed.

Driller: J. Gibson
Technician: J. Byars
Drilling Equipment: Failing 250 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 30 ft.
DATE: August 27, 1987

SAMPLER: 3-in. Thin-walled Tube

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

PLATE 2

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-149

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	Description	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125)	PENETROMETER
	1Q		FILL: CLAY, firm, brown and gray						
			-with large cracks to 0.6'						
	2Q		-with sand pockets below 1'						1.0
5	3Q								1.2
	4Q								1.6
			-soft below 8'						
10	5Q								0.7
	6Q								0.8
			-clayey sand; with shell fragments, 12' to 14' (14')						
	7Q								
15			SANDY CLAY, stiff, gray and brown, with calcareous nodules						
	8Q		-with shell fragments to 16'						1.7
	9Q								2.1
20	10Q								2.2
	11Q								3.1
			-silty sand layer below 23.5' (24')						
	12Q								2.8
25			CLAY, stiff, brown						
	13Q		-with silt partings and silty clay seams to 27'						3.7
	14Q		-very stiff to 28'						3.7
30	15Q								2.6
	16Q		-brown and gray below 32'						2.2
	17Q								2.7
35	18Q								2.3
	19Q		-with sand pockets below 38'						3.6
40	20Q		(40')						2.8
			*Disturbed sample						
45			Driller: J. Gibson Technician: J. Byars Drilling Equipment: Failing 250 on Ardco Buggy						
50									

JOB NO.: 0187-0508

COMPLETION DEPTH: 40 ft.

DATE: August 27, 1987

SAMPLER: 3-in. Thin-walled Tube

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND

- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane

(open symbols above indicate remolded tests)

- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-150

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH, KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125)	PENETROMETER
		1Q*	FILL: CLAY, firm, brown and gray						1.0
			- dry, desiccated, with fissures to 2'						
			- soft, 2' to 4'						0.7
		2Q*							
5			- with sand seams and pockets below 4'						1.0
		3**							
		4Q	- stiff, 6' to 8' (3-in. sample)						1.7
									1.3
10		7Q							
		8Q	(12')						0.4
		9**	SANDY CLAY, soft, gray, with sand seams						
15		10**							
		11Q	(18')						
		12Q	CLAYEY SILT, brown						
20			- sand to 19.5'						
		13Q							
		14Q	(24.5')						
25		15Q	CLAY, stiff, brown						1.2
			- firm to 26', and 32' to 34'						
		16Q							1.8
30		17Q							1.8
		18Q							2.0
		19Q	- gray and brown, 32.5' to 34'						1.5
35		20Q							1.7
		21Q							
			← 3 attempts						
40			(40.5')						
		22Q	CLAYEY SILT, gray and brown (42')						1.7
45			* 6-in.-diameter sample						
			** Samples 4 and 5 are 6-in. quart samples at 8 and 10 ft, respectively. Samples are highly disturbed. Six-inch samples became difficult to recover after 6 ft. After the 6-in. sample at 10-ft depth, the boring was moved -5 ft over, and restarted.						
50									

Driller: J. Gibson
Technician: J. Byars
Drilling Equipment: Failing 250 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 42 ft.
DATE: August 29, 1987

SAMPLER: 6- and 3-in. Thin-walled Tube

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-151

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5) / KILOPASCALS (25, 50, 75, 100, 125)	PENETROMETER
	1Q		FILL: CLAY, firm, brown						4.1
	2Q		- very stiff to 2'						1.0
5	3Q								1.0
	4Q		-very soft and gray below 6'						0.4
10	5Q								0.4
	6Q		-brown sand below 10' -with shell fragments below 11.5' (12')						
15			SANDY CLAY, very soft, gray, with numerous shells (technician: thick soup)						
20	7Q		(20.5')						
	8Q		SILTY CLAY, soft gray and brown, with sand seams and shell fragments (22.5')						0.7
	9Q		SILTY SAND, brown, fine, wet, with silty clay layers						
25	10Q		(26')						
	11Q		SILTY CLAY, stiff, light brown (28')						1.7
30	12Q		CLAY, stiff, gray and brown						
	13Q		- brown, 30' to 34'						2.0
	14Q								2.2
35	15Q								2.1
	16 5"		-with shell fragments below 36' (39')	Push					
40	17Q		SILTY CLAY, stiff, gray and brown (40')						2.2
45			Driller: J. Gibson Technician: J. Byars Drilling Equipment: Failing 250 on Ardco Buggy						
50									

JOB NO.: 0187-0508
COMPLETION DEPTH: 40 ft.
DATE: August 28, 1987

SAMPLER: 3-in. Thin-walled Tube

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-152

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

DEPTH, FT.	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125)	PENETROMETER
		1Q*	FILL: CLAY, firm, brown and gray - stiff to 2'						3.8
		2Q*							1.5
5		3Q*	- soft, 4' to 6' - very soft below 6' - with sand pockets and seams and organic matter below 7.5' (10')						
		4Q**							
10		5T	SILTY FINE SAND, tan - with shell layers below 12' (15')						
15		6Q	CLAY, soft, gray with shell fragments (19')						
20		7T	SAND, very loose, fine, light gray - with clay pockets and seams to 23'						
25		8T							
		9T	(27.5')	1-1-2					
		10Q	CLAY, firm, brown and gray - with organic matter to 30'						1.5
30		11Q							1.5
		12T							1.7
35		13Q							1.5
		14Q							1.5
40		15Q							2.3
		16Q	(42')						3.0
		17Q	SILTY CLAY, very stiff, brown and gray with silt pockets - stiff with silt seams below 44'						3.5
45		18Q	(46')						2.0
		19Q	LAMINATED SILT, CLAYEY SILT AND CLAY, brown						
50		20Q	(50')						

* 6-in. diameter sample
** sample broke in half, no quart saved

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 50 ft.
DATE: SEPTEMBER 4, 1987

SAMPLER: 6-in. Thin-walled Tube
2-in. Split Barrel Sampler
3-in. Thin-walled Tube
DRILLING METHOD: WET ROTARY

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane
- (open symbols above indicate remolded tests)
- Torvane
- Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 6

LOG OF BORING NO. 87-153

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit — Natural — Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125)	PENETROMETER
	1Q		CLAY, firm, brown and gray - stiff to 1'						4.2
	2Q								1.0
5	3Q		- with sand pockets and seams below 5.5'						1.0
	4G		(9.5')						1.3
10	5Q		SILTY FINE SAND, loose, tan with clay seams	3-4-5					0.8
	6T								
			- very loose shell layer below 14'	4-1-2					
15			(17')						
			CLAY, soft, gray with shell fragments (20')						
20	7T		SILTY FINE SAND, loose, light gray						
	8T								
			- with clayey silt layers below 23.5'	2-2-4					
25	9T		(28)						
			CLAY, firm, gray and brown - with organic matter to 30'						
30	10Q								1.3
	11Q								1.3
	12Q		- stiff, 34' to 36'						1.6
35	13Q								2.0
	14Q								1.5
40	15G		(41.5')						1.5
	16G		SILTY CLAY, firm, gray and brown						1.5
	17Q		- stiff below 42'						2.3
45	18G		(46')						2.4
			LAMINATED CLAY, CLAYEY SILT AND SILT, firm, brown and gray						
	19Q								1.5
50	20Q		(50')						1.5

Driller: W. Self
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 50 FT.
DATE: SEPTEMBER 2, 1987
DEPTH TO WATER IN BORING: 5.0'
CAVED AT: 8.8'
DATE: 9-2-87

SAMPLER: 3-in. Thin-walled Tube & 2-in. Split Barrel Sampler

DRILLING METHOD: WET ROTARY

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 7

LOG OF BORING NO. 87-154

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20 40 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5 1.0 1.5 2.0 2.5; KILOPASCALS 25 50 75 100 125)	PENETROMETER
			CLAY, stiff, brown and gray with sand seams						
	1Q*		- firm, 2' to 4'						2.6
	2Q*		- with sand pockets and shell fragments below 2'						1.5
5	3Q								1.7
	4Q**								1.7
10	5J		- with clayey silt layers below 10' (12')						
			CLAY, very soft, gray with shell fragments and sand seams						
	6G		- soft below 14'						
15	7Q		- numerous shell fragments below 16'						
	8Q		(20')						
20	9J		SILTY FINE SAND, tan, loose						3.0
	10J		- with clay seams to 23.5'						
			- with silt and clayey silt seams below 23.5' (25')	3-3-3					
25	11J		SILTY CLAY, stiff, brown and gray with silt pockets						1.8
	12Q		(28')						
	13Q		CLAY, stiff, brown and gray						3.0
30	14Q		- firm, 30' to 31'						1.5
	15Q								2.0
									2.2
35	16G								
	17G		- with silt pockets and seams 37' to 41'						3.2
	18Q								3.0
40	19Q								3.1
	20Q								2.6
45	21Q								2.9
	22Q		- with silt partings 47' to 53'						2.7
	23G		(50')						
50			(CONTINUED ON PLATE 8b)						

* 6-in.-diameter samples

** Push twice to obtain sample; only 6-in. length

JOB NO.: 0187-0508

SAMPLER: 6-in. Thin-walled Tube, 3-in. Thin-walled Tube & 2-in. Split Barrel Sampler

DRILLING METHOD: WET ROTARY

STRENGTH LEGEND

- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane

(open symbols above indicate remolded tests)

- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-154 (CONT'D)

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

(Continued from Plate 8a)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5) / KILOPASCALS (25, 50, 75, 100, 125)	PENETROMETER
			CLAY, stiff, brown and gray - with silt partings, 47' to 53' - with silt seams below 53'						
55	24Q								2.3
			(58')						
			CLAY, stiff, gray with sand pockets - sand seams, 59' to 61'						
60	25Q								2.0
65	26Q								1.3
			(68')						
			CLAY, stiff, brown and gray with organic matter - with sand seams at 69.5'						
70	27Q								2.5
75	28Q		(75')						2.2

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-050B
COMPLETION DEPTH: 75'
DATE: 9-3-87
DEPTH TO WATER IN BORING: 4.1'
CAVED AT: 19.3'
DATE: 9-3-87

SAMPLER: 3-in. Thin Walled Tube
2-in. Split Barrel Sampler

DRILLING METHOD: WET ROTARY

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-155

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5) / KILOPASCALS (25, 50, 75, 100, 125)	PENETROMETER
		1Q	CLAY, firm, gray and brown						2.3
		2Q	- stiff to 2'						0.8
			- sand pockets and seams below 2'						
5		3Q							1.2
		4Q							1.6
		5Q							1.5
10			- soft below 10'						
		6Q							0.6
			(13.5')						
		7Q	CLAY, soft, gray with shell fragments and sand pockets						
15		8Q							
		9Q							
20		10Q							
			(21')						
		11Q	SILTY FINE SAND, tan, medium dense						
			- with clay seams below 24.5'						
25		12Q	(26')	10-11-8					
			CLAY, stiff, brown and gray						
		13Q	- firm, 28' to 32'						1.8
30		14Q							1.5
		15Q							1.5
		16Q							1.7
35		17Q							1.7
		18Q							2.5
40		19Q							2.6
			(41.5')						1.7
		20Q	SILTY CLAY, firm, gray and brown with silt pockets						
		21Q	(44')						1.0
45		22Q	LAMINATED CLAY, CLAYEY SILT AND SILT						1.4
		23Q							1.3
50		24Q	(50')						1.7

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 50
DATE: 9/1/87
DEPTH TO WATER IN BORING: 44'
CAVED AT: 40.3'
DATE: 9-1-87

SAMPLER: 3-in. Thin-walled Tube
2-in. Split Barrel Sampler

DRILLING METHOD: WET ROTARY

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

PLATE 9

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-156

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (KILOPASCALS)	PENETROMETER
		1T	CLAY, stiff, brown and gray						3.2
			- with sand pockets and seams below 2'						1.2
		2Q	- firm, 2' to 4' and 6' to 8'						
5		3Q							1.7
		4Q							1.0
		5T	- soft below 8'						
10									
		6Q	(14')						
15		7Q	CLAY, soft, gray with sand pockets and shell fragments						
		8Q							
			(20')						
20		9Q	SILTY FINE SAND, tan, medium dense						
		10T							
25		11T		59-14					
			(28.5')						
30		12T	CLAY, firm, gray and brown - with organic matter to 30'	1-3-4					1.5
		13Q							1.5
		14Q	- stiff, 32' to 38'						2.2
35		15Q							2.3
		16Q							2.1
			- very stiff, 38' to 40' and below 42'						4.0
40		17Q							1.2
		18Q							3.4
			(44')						
45		19Q	SILTY CLAY, stiff, brown and gray with silt pockets						2.0
		20Q	- with silt seams below 46'						2.6
		21Q							2.1
50		22Q							

(continued on Plate 10b)

JOB NO.: 0187-0508

SAMPLER: 3-in. Thin-walled Tube
2-in. Split-Barrel Sampler

DRILLING METHOD: WET ROTARY

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-156 (CONT'D)

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

(continued from Plate 10a)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20 40 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5 1.0 1.5 2.0 2.5; KILOPASCALS 25 50 75 100 125)	PENETROMETER
			SILTY CLAY, stiff, brown and gray with silt pockets (53')						
55		23Q	CLAY, very stiff, brown and gray with silt partings						3.6
60		24Q	(63')						4.0
			CLAY, stiff, gray						
65		25Q							2.1
70		26Q							1.8
75		27Q	(75')						2.4

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 75
DATE: 9-1-87
DEPTH TO WATER IN BORING: 3.5'
CAVED AT: 4.5'
DATE: 9-1-87

SAMPLER: 3-in. Thin-walled Tube
2-in. Split-Barrel Sampler

DRILLING METHOD: WET ROTARY

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

PLATE 10b

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-157

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SAMPLES	LOCATION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	PENETROMETER
	1.7	FILL: CLAY, very stiff, brown and gray, with sand pockets and seams - firm below 2' (3.5')				4.5
5	2.7	SAND, loose, tan, fine - soft clay layer, 5.5' to 7'	2-2-3			
	3.3	- with clay seams below 8'				
10	4.3		3-3-3			
	5.7	(13')				
15	6Q	CLAY, soft, gray, with sand pockets (18')				
20	7.3	SAND, dense, tan, fine	11-19 -19			
	8.7					
25	9.7	- clay seam at 24.5'	13-23 -24			
		(28.5')				
30	10.3	CLAY, stiff, brown and gray	3-4-9			2.5
	11Q	- sand layer, 33' to 34.5' (34')				2.5
40	12Q	SILTY CLAY, stiff brown and gray, with silt pockets				2.4
	13Q	(49.5')				2.2
50	14Q	CLAY, firm, gray				3.0
	15Q	- stiff, gray and brown to 53' and below 68'				1.4
60	16Q					1.4
	17Q					1.3
70	18Q	(70')				2.0

WATER CONTENT, %: Plastic Limit — Natural — Liquid Limit; 20, 40, 60

UNDRAINED SHEAR STRENGTH: KIPS PER SQ FT 0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125

NOTE SCALE CHANGE

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 70 ft.
DATE: August 28, 1987

SAMPLER: 3-in. Thin-walled Tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 11

LOG OF BORING NO. 87-158

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (KILOPASCALS)	PENETROMETER
		1Q	CLAY, stiff, brown and gray with sand pockets and seams						4.6
		2Q	-stiff to 1'						2.6
5		3Q							2.8
		4Q							1.8
10		5Q	- with silt seams below 10'						1.0
		6Q	- silt layer with soft clay seams 11' to 12' (13')						0.7
		7Q							1.0
15		8J	SILTY FINE SAND, medium dense, tan (18')	5-5-7					
20		9J	CLAY, soft, gray with sand pockets and seams						
		10Q							
		11Q	(24')						
25		12Q	LAMINATED SILT, CLAYEY SILT and SAND, brown (29.5')						
30		13J 14J	SILTY FINE SAND, medium dense, tan (33')	1-2-9					
35		15J	CLAY, stiff, gray - with sand pockets and seams below 35' (37')	2-4-5					2.1
		16Q							3.0
40		17Q	CLAY, stiff, brown and gray - with silt pockets, 39' to 47' - with silty clay seams, 41' to 43'						2.7
		18Q							3.1
		19Q							2.0
45		20Q							3.0
		21Q							3.1
		22Q	(50')						3.0
50		23Q	SILTY CLAY, stiff, gray and brown with silt pockets						3.0
		24Q	- with clayey silt seams below 53'						2.3
55		25Q							

JOB NO.: 0187-0509

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

PLATE 12a

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-158 (CONT'D)

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

DEPTH, FT	SYMBOL	SAMPLES	(continued)	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit — Natural — Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5) / KILOPASCALS (25, 50, 75, 100, 125)	PENETROMETER
55			SILTY CLAY, stiff, gray and brown with silt pockets and clayey silt seams (58.5')						
		26Q							2.3
60		27Q	CLAY, stiff, brown and gray with silt pockets						
		28Q	- with clayey silt seams and silt seams to 61'						3.2
		29Q							3.3
65		30Q	- with silty clay layer below 65' (66.5')						
		31Q							3.0
			CLAY, firm, gray						
		32Q							
70		33Q							1.6
		34Q							1.5
75		35Q							1.4
		36Q							1.4
		37Q	- stiff 78' to 92' and 98' to 102'						1.7
80		38Q	and below 105'						2.3
85									
		39Q							1.7
		40Q							2.5
90		41Q	- very stiff below 92'						2.5
		42Q	- gray and brown, 93' to 97'						3.4
95		43Q							3.8
		44Q							4.0
		45Q	- with calcareous nodules and sand pockets, 93' to 99'						3.0
100		46Q							4.1
		47Q							4.2
105		48Q							4.4
		49Q							3.0
110			(110')						

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 110'
DATE: August 26 1987
DEPTH TO WATER IN BORING: 10.2'
CAVED AT: 13.0'
DATE: August 26, 1987

SAMPLER: 3-in. Thin Wall Tube and 2-in. Split Barrel Sampler
DRILLING METHOD: WET ROTARY

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 126

LOG OF BORING NO. 87-159

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5) / KILOPASCALS (25, 50, 75, 100, 125)	PENETROMETER
		1Q	FILL: CLAY, stiff, brown and gray (3')						2.3
5		2S	FILL: SILTY SAND, tan, fine, with clay seams and pockets (8')						
10		3S	CLAY, very soft, gray, with sand pockets	1 blow for 18"					
15		4Q	(17.5')						
20		5Q	CLAY, stiff, brown and gray - with silt seams and pockets to 29'						2.2
25		6Q	- firm and gray, with wood fragments, 23.5' to 29'						1.0
30		7Q							2.4
		8Q							2.5
40		9Q	(42')						2.7
		10Q	SILTY CLAY, stiff, gray and brown, with silt pockets (48')						3.0
50		11Q	LAMINATED SILT, CLAYEY SILT, AND CLAY brown firm (52')						1.2
		12Q	CLAY, stiff, brown and gray - very stiff and gray, with silt seams to 59'						3.7
60		13Q							2.0
		14Q							1.8
70		15Q	- firm below 68' (70')						1.0

Note Scale Change

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 70 ft.
DATE: August 25, 1987
DEPTH TO WATER IN BORING: 5.6'
CAVED AT: 5.9'
DATE: August 25, 1987

SAMPLER: 3-in. Thin-walled Tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 13

LOG OF BORING NO. 87-160

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20 40 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5 1.0 1.5 2.0 2.5) / KILOPASCALS (25 50 75 100 125)	PENETROMETER
		FILL: CLAY, firm, brown and gray with sand pockets						
	1Q							2.6
	2Q	- stiff to 2'						
		- with sand seams to 8' 700 psf						
5	3Q							1.3
	4Q							1.2
10	5Q							1.4
		- soft, 10' to 14'						
	6Q	250 psf						0.5
	7Q							0.4
15	8Q	(16')						1.3
		CLAY, soft, gray						
	9Q	- with sand pockets below 18'						
20	10Q							
	11Q	(22')						
		SILTY SAND, dense, tan, fine						
25	12J	$\phi = 50$						
30	13J		13-23 -18					
		(33.5')						
35	14J	CLAY, stiff, gray and brown						1.
	15Q	- with silt pockets and silty clay seams, 37' to 40'						1.
	16Q							3.
40	17Q	- very stiff, 40' to 43'						3.
		- brown and gray below 40'						
	18Q							4
45	19Q							2
	20Q	(47')						2
		SILTY CLAY, firm, gray and brown						
	21Q	- stiff to 49'						1
50	22Q							1
	23Q							1
55	24Q	- continued -						1

JOB NO.: 0187-0508

SAMPLER: 3-in. Thin-walled Tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✧ Torvane
- ⊠ Hand Penetrometer

47
12
34

McCLELLAND ENGINEERS

PLATE 14

LOG OF BORING NO. 87-160 (Cont'd)

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES		BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125)	PENETROMETER
			SILTY CLAY, firm, gray and brown - laminated silt, clayey silt, and clay below 56.5' (58.5)						
	25Q								1.2
	26Q								2.5
60			CLAY, stiff, brown and gray - very stiff, with silt pockets to 63'						
	27Q								4.0
	28Q								4.5
65	29Q		- gray, 65' to 89'						3.3
	30Q								2.8
	31Q								2.3
70	32Q								2.0
	33Q								1.8
									1.7
75	34Q		- with shell fragments, 75' to 77'						1.7
	35Q								2.3
	36Q								1.8
80	37Q		- with wood fragments, 81' to 83.5'						1.7
	38Q								2.2
85	39Q								2.6
	40Q								3.2
	41Q								4.2
90	42Q		- very stiff, with calcareous nodules below 89'						
			- with sand layers, with shell fragments and clay seams, 91' to 96'						
95	43Q								4.5'
	44Q								4.2
100	45Q								
			- stiff, 102' to 105'	11-10 -15					2.3
	46T								3.5
105	47Q								4.2
	48Q								
110	49Q		- sand, with clay pockets below 108' (110')						

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-050B
COMPLETION DEPTH: 110 ft.
DATE: August 21, 1987
DEPTH TO WATER IN BORING:
CAVED AT:
DATE:

SAMPLER: 3-in. Thin-walled Tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 14b

LOG OF BORING NO. 87-161

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (KILOPASCALS)	PENETROMETER
		1.5, 2.5	FILL: CLAY, very stiff, brown and gray, and SILTY SAND, tan, fine (2')						4.5+
5		3Q	FILL: CLAY, firm, brown and gray with sand pockets (8')						1.6
10		7.5, 9.5, 12.5	SILTY SAND, very loose, tan, fine - gray, with shell fragments below 9' (12')	3-2-2					
15		7Q	CLAY, firm, gray - with very soft, vertical clay seam, 13' to 15'						1.0
20		8Q	- stiff, with silt pockets and seams, 20' to 23.5' - brown and gray below 23'						3.0
25		9Q	(27')						1.6
30		10.5	SILTY CLAY, soft, tan - stiff to 30'						1.9
		11Q							0.7
35		12Q	- with silt and clayey silt seams below 33' (36.5')						
40		13Q	CLAY, stiff, brown and gray, with silt seams (44.5')						1.8
		14Q, 15.5							2.2
45			LAMINATED SILT, CLAYEY SILT, AND CLAY, medium-dense, brown						
50		16.5	(53')	8-10-11					
55		17Q	CLAY, very stiff, brown and gray (cont'd)						4.5

JOB NO.: 0187-0508

SAMPLER: 3-in. Thin-walled tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✧ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 15a

LOG OF BORING NO. 87-161 (Cont'd)

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

DEPTH, FT	SYMBOL	SAMPLES	Continued	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20 40 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5 1.0 1.5 2.0 2.5; KILOPASCALS 25 50 75 100 125)	PENETROMETER
			CLAY, very stiff, brown and gray						
60		18Q	- gray, 59' to 83'						3.5
			- stiff, 63' to 68'						2.5
65		19Q							
			- firm, 68' to 73'						1.5
70		20Q							
			- with wood fragments, 73' to 75'						1.0
75		21Q							
			- stiff, 78' to 93'						2.5
80		22Q							
		23Q	- gray and brown, 83' to 88'						3.3
			- with shell fragments, 83' to 90'						
85									
			- brown and gray below 88'						3.1
90		24Q							
									3.6
95		25Q							
									3.4
100		26Q							
			(103') SAND, medium-dense, tan, fine, with few small clay seams and pockets						
105		27S							
			(108.5') CLAY, tan, with shell fragments (110')	88-11					
110		28S							

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-050B
COMPLETION DEPTH: 1100 ft.
DATE: August 19, 1987
DEPTH TO WATER IN BORING:
CAVED AT:
DATE:

SAMPLER: 3-in. Thin-walled Tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

PLATE 15b

McCLELLAND ENGINEERS

LOG OF BORING NO. 87-162

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20 40 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5 1.0 1.5 2.0 2.5; KILOPASCALS 25 50 75 100 125)	PENETROMETER
	1T		FILL: CLAY, very stiff, gray and tan with sand pockets (2')						4.5+
	2Q		CLAY, stiff, brown and gray, with sand pockets						2.0
	3T								
5	4Q		- firm below 4' (5')						1.1
	5T		SILTY SAND, very loose, gray, fine, with clay seams						
10	6T		(12')	1-1-1					
	7Q		CLAY, firm, gray and tan						1.3
15	8Q		- stiff, tan and gray, with calcareous nodules below 14'						2.8
	9Q		(17')						
	10T		SILTY SAND, medium-dense, tan, fine with clay seams (19.5')	8-9-8					
20	11Q		CLAY, stiff, brown and gray - with silt pockets to 24' - with gypsum pockets, 22 to 24'						1.7
	12Q								2.5
25	13Q								1.8
	14Q								2.0
30	15Q		- firm, 30' to 32'						3.3
	16Q		- very stiff, 32' to 36'						1.6
	17Q								3.8
35	18Q								3.6
	19Q								3.3
40	20Q		(40')						3.2
45									
50									

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 40 ft.
DATE: August 18th, 1987
DEPTH TO WATER IN BORING:
CAVED AT:
DATE:

SAMPLER: 3-in. Thin-walled Tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 16

LOG OF BORING NO. 87-181

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	Description	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit – Natural – Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125)	PENETROMETER
		1Q	FILL: CLAY, firm, brown and gray, with sand seams						1.3
		2Q							1.1
5		3Q							1.3
		4Q							1.0
10		5Q							1.5
		6Q							1.6
		7Q	(14')						1.0
15		8Q	CLAY, firm, gray and brown - stiff to 16'						3.0
		9Q							1.0
20		10Q	- with silt seams and pockets, 18' to 24'						1.2
		11Q							1.6
		12Q	- brown and gray, with sand pockets, 24' to 30'						1.3
25		13Q	- with shell fragments, 26' to 30'						1.5
		14Q							1.5
30		15Q							1.5
		*	- soft, 30' to 32' - gray below 30' - with sand seams and pockets below 32'						
		16Q							0.8
35		17Q							
		18Q	← 2 attempts						
		19Q	(40')						
40		*	SAND, dense, tan, fine						
		20Q				14-20 -21			
		21Q				16-21 -28			
50		22Q	(53')						
		23Q	CLAY, stiff, gray and brown with sand pockets						2.5
		24Q	- with sandstone nodules, 56' to 58'						3.0
60		25Q	- very stiff below 58' (60')						3.4

NOTE SCALE CHANGE

* Tube pulled off sample during recovery.

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 60 ft.
DATE: August 27, 1987
DEPTH TO WATER IN BORING: 19.2'
CAVED AT: 41.2'
DATE: August 27, 1987

SAMPLER: 3-in. Thin-walled Tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 17

LOG OF BORING NO. 87-182

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20, 40, 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5; KILOPASCALS 25, 50, 75, 100, 125)	PENETROMETER
			FILL: CLAY, firm, brown and gray						
	1Q								1.5
			- soft, 2' to 4'						
	2Q								0.8
			- stiff, 4' to 6'						
5	3Q		- with sand pockets below 6'						2.0
	4Q								1.0
10	5Q								1.0
	6Q								0.9
	7Q								1.0
			- soft, 14' to 20'						
15	8Q		- with sand seams below 14'						0.6
	9Q								0.5
20	10Q								0.8
	11Q								1.6
	12Q								1.5
25	13Q								1.2
			- with silt seams, 26' to 28'						
	14Q								
30	15Q								1.6
	16Q								1.2
	17Q		(34')						1.2
35			CLAY, soft, gray, with sand pockets						
	18Q								0.6
	19Q		(38')						0.7
			LAMINATED SILT, CLAYEY SILT, SAND, AND CLAY, brown						
40	20Q		(41.5')						
	21Q		CLAY, stiff, brown & gray (43')						2.2
			SILTY SAND, medium-dense, tan, fine (48.5')	10-15-15					
50			CLAY, stiff brown and gray	4-6-7					3.0
									2.3
									2.2
									2.8
									2.2
60			- very stiff below 58' (60')						3.9

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

NOTE SCALE CHANGE

JOB NO.: 0187-050B
COMPLETION DEPTH: 60 ft.
DATE: August 24, 1987
DEPTH TO WATER IN BORING: 15.7'
CAVED AT: 70.3'
DATE: August 24, 1987

SAMPLER: 3-in. Thin-walled Tube and 2-in. Split-barrel Sampler

DRILLING METHOD: Wet Rotary

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 18

LOG OF BORING NO. 87-183

SNAKE ISLAND DISPOSAL AREA

TEXAS CITY, TEXAS

LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION	BLOWS PER FT	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT, % (Plastic Limit / Natural / Liquid Limit; 20 40 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5 1.0 1.5 2.0 2.5; KILOPASCALS 25 50 75 100 125)	PENETROMETER
		1T	CLAY, firm, brown and gray with sand seams - soft below 2'						1.0
		2Q	(4')						0.6
5		3T	SILTY FINE SAND, gray (8.5')						
10		4T 5Q	CLAY, very soft, gray - soft below 12						
		6Q	(14')						
15		7T	SILTY FINE SAND, tan - with clay seams below 17.5' (19')						2.0
20		8Q	CLAY, stiff, brown and gray - with silt pockets to 26' - with clayey silt seams 20' to 22'						2.4
		9Q							1.6
		10Q							1.7
25		11Q							1.7
		12Q							2.3
30		13Q	(30')						

Driller: A. Clark
Technician: J. McCoy
Drilling Equipment: Mobile B-53 on Ardco Buggy

JOB NO.: 0187-0508
COMPLETION DEPTH: 30'
DATE: 9-4-87

SAMPLER: 3-in Thin-walled Tube

DRILLING METHOD: WET ROTARY

STRENGTH LEGEND
- ● Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- ✦ Miniature Vane
- (open symbols above indicate remolded tests)
- ✦ Torvane
- ⊠ Hand Penetrometer

McCLELLAND ENGINEERS

PLATE 19

APPENDIX II

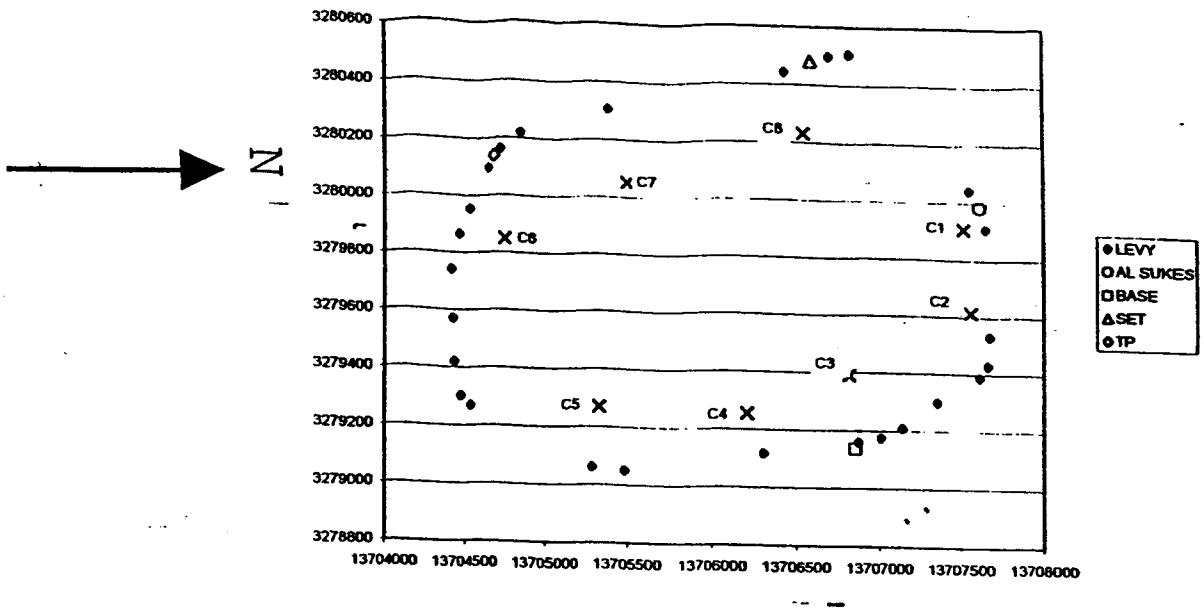
FIGURE A-1: BORING LOCATION PLAN

FIGURE A-2: SUBSURFACE PROFILE

SPT LEGEND

SOIL TEST BORING LOGS

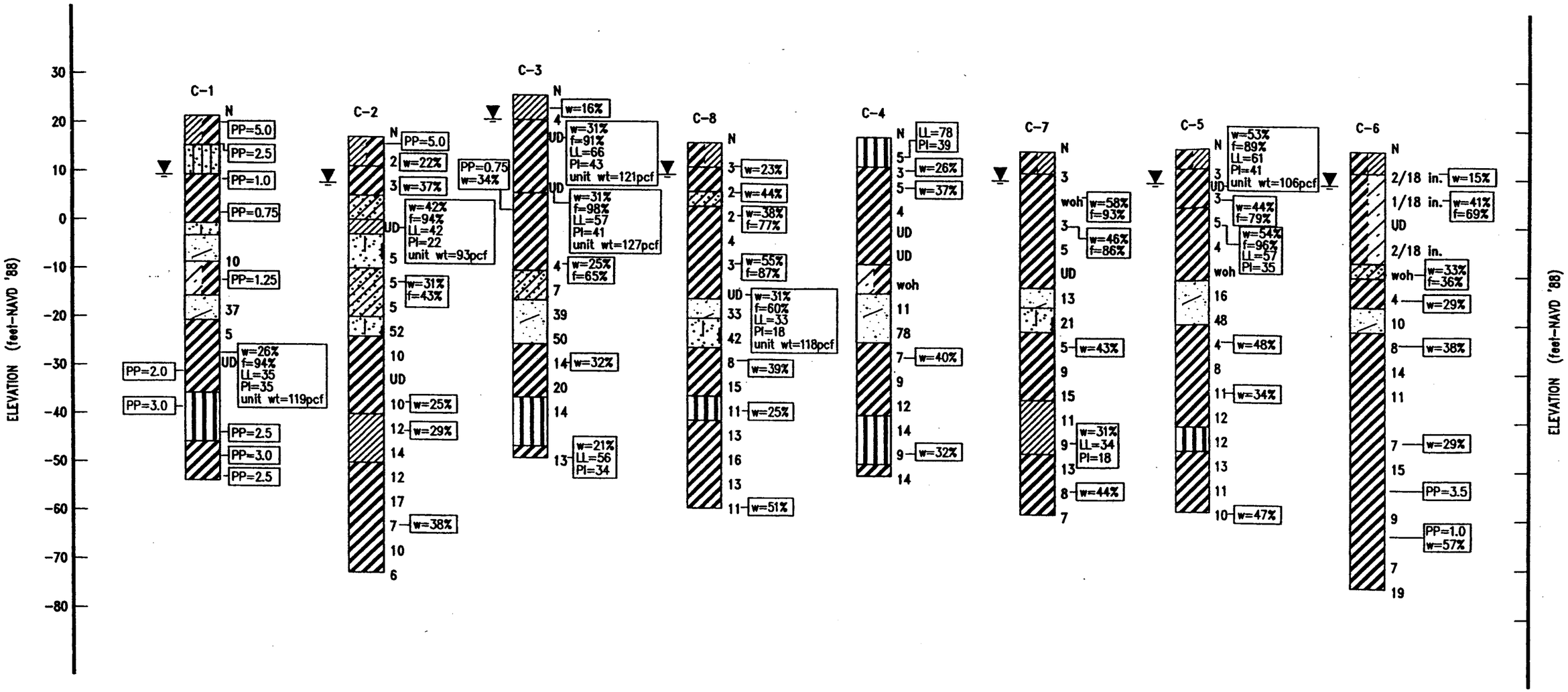
FIELD INVESTIGATION PROCEDURES



	NAD '83		NAVD '88	
12	13707615.12	3279983.554	28.371	AL SUKES 2914
1	13706853.99	3279137.238	31.539	BASE
11	13707518.29	3279906.254	21.113	C-1
10	13707558.29	3279615.236	17.028	C-2
3	13706816.17	3279389.739	25.798	C-3
16	13706204.45	3279253.145	17.568	C-4
19	13705329.26	3279267.792	15.663	C-5
27	13704750.91	3279845.914	15.643	C-6
33	13705501.97	3280050.022	15.035	C-7
36	13706545.76	3280229.488	16.271	C-8
2	13706869.68	3279158.722	31.328	LEVY
4	13707009.06	3279174.719	30.097	LEVY
5	13707139.11	3279209.727	27.363	LEVY
6	13707353.07	3279299.025	26.935	LEVY
7	13707610.21	3279387.885	25.877	LEVY
8	13707662.67	3279428.791	25.062	LEVY
9	13707672.26	3279532.36	24.774	LEVY
13	13707649.28	3279908.757	26.936	LEVY
14	13707551.72	3280041.31	29.584	LEVY
15	13706305.04	3279116.483	27.323	LEVY
17	13705479.04	3279049.877	27.042	LEVY
18	13705288.36	3279059.286	27.261	LEVY
20	13704532.9	3279269.126	26.705	LEVY
21	13704468.57	3279302.212	26.586	LEVY
22	13704429.36	3279419.588	26.185	LEVY
23	13704422.49	3279570.67	25.926	LEVY
24	13704413.15	3279738.873	26.227	LEVY
25	13704464.17	3279862.761	26.933	LEVY
26	13704528.81	3279950.935	26.528	LEVY
29	13704648.16	3280094.612	26.633	LEVY
30	13704724.51	3280159.644	26.822	LEVY
31	13704851.93	3280217.446	26.242	LEVY
32	13705392.84	3280304.176	27.301	LEVY
34	13706434.63	3280441.785	28.183	LEVY
38	13706702.83	3280496.003	27.585	LEVY
39	13706827.63	3280504.998	27.086	LEVY
37	13706593.03	3280480.061	27.653	SET 12 IR
28	13704684.2	3280138.375	26.655	TP 5A DIST

Survey data furnished by Shiner, Moseley and Associates, Inc.

Job No : 1131-99-588	S&ME	**BORING LOCATION PLAN** Proposed Shoal Point Container Terminal Texas City, Texas	Figure No: A-1
Date: October 22, 1999			
Not to Scale			



Soil Classification

- Low/High Plasticity Clay
- SM, Silty Sand
- High Plasticity Clay
- Slightly Silty Sand
- Slightly Clayey Sand
- Very Clayey Sand
- High Plasticity Silt
- SC, Clayey Sand
- Low Plasticity Clay
- Very Sandy Clay

Legend:

PP	POCKET PENETROMETER READING (tsf)
w	NATURAL MOISTURE CONTENT (%)
f	% FINES CONTENT (< #200 sieve)
LL	LIQUID LIMIT
PI	PLASTICITY INDEX
N	STANDARD PENETRATION TEST RESISTANCE VALUE
UD	"UNDISTURBED" SHELBY TUBE SAMPLE

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

S&ME

ENVIRONMENTAL SERVICES · ENGINEERING · TESTING

Subsurface Profile
Proposed Shoal Point Container Terminal
Texas City, Texas

SCALE: 1"=20'	DRAWN BY: KLE	APPROVED BY:
JOB NO. 1131-99-588	DATE: 10-20-99	FIGURE NO. A-2

SPT LOG LEGEND

SOIL CLASSIFICATION

CL, LOW PLASTICITY CLAY	SC, CLAYEY SAND
CH, HIGH PLASTICITY CLAY	SP–SC, SLIGHTLY CLAYEY SAND
ML, LOW PLASTICITY SILT	SM, SILTY SAND
MH, HIGH PLASTICITY SILT	SP–SM, SLIGHTLY SILTY SAND
SP, "CLEAN" SAND	WATER
	MARL

N VALUE	STANDARD PENETRATION TEST RESISTANCE VALUE (blows per foot)
woh	WEIGHT OF HAMMER
wor	WEIGHT OF DRILLING RODS
S	SPLIT SPOON SAMPLE
UD	"UNDISTURBED" SHELBY TUBE SAMPLE
w	NATURAL MOISTURE CONTENT (%)
f	% FINES CONTENT (≤ #200 sieve)
LL	LIQUID LIMIT
PI	PLASTICITY INDEX
Cc	COMPRESSION INDEX
e	VOID RATIO
Su	UNDRAINED SHEAR STRENGTH (ksf)
Sv	TORVANE (ksf)
PP	POCKET PENETROMETER READING (tsf)

S&ME

PROJECT: SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588		BORING LOG C-1
DATE DRILLED: 9/7/99	ELEVATION: 21.1	NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevations reference NAVD '88
DRILLING METHOD: Mud Rotary	BORING DEPTH: 75.0 feet	
LOGGED BY: GREG	WATER LEVEL:12 ft. after 24 hrs.	
DRILLER: VAN & SONS	DRILL RIG: FAILING-36	

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	SAMPLE NO/TYPE	N VALUE
	CLAY (CL/CH) hard, brown, slight and root content, moist, PP = 5.0		U-1, U-2	
5	- - -	16.1	U-3	
	- - - dark gray, fine sand seams, becoming very moist, PP = 5.0 to 2.5 w/depth			
	SILTY SAND (SM) very loose, fine, with high interbedded clay content	11.1	U-4	
10				
	CLAY (CH) firm, dark gray with olive, some sand seams, PP = 1.0, TV = 0.45	6.1	U-5	
15				
20	- - - gray and olive brown, black coarse graded sand seams, PP = 0.7, TV = 0.15	1.1	U-6	
	SLIGHTLY SILTY SAND (SP-SM) very loose, gray, fine, interbedded clay content		U-7	
25	**SLIGHTLY CLAYEY SAND (SP-SC)** loose, light gray, fine	-3.9		
		-8.9	S-1	10
30	**CLAYEY TO VERY CLAYEY SAND (SC/CH)** dark gray, fine clay lenses, PP = 1.25, TV = 0.25		U-8	
35		-13.9		
	SLIGHTLY CLAYEY SAND (SP-SC) dense, gray and brown, fine			
40		-18.9	S-2	37
	CLAY (CH) firm, light grayish brown, slight sand content			
45		-23.9	S-3	5

STANDARD PENETRATION TEST DATA (blows/ft): 10, 20, 30, 60, 80

WATER LEVEL

BORING LOG 99588.GPJ S&ME.GDT 11/10/99

1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

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PROJECT:	SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588	BORING LOG C-1
DATE DRILLED: 9/7/99	ELEVATION: 21.1	NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevations reference NAVD '88
DRILLING METHOD: Mud Rotary	BORING DEPTH: 75.0 feet	
LOGGED BY: GREG	WATER LEVEL:12 ft. after 24 hrs.	
DRILLER: VAN & SONS	DRILL RIG: FAILING-36	

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO/TYPE	STANDARD PENETRATION TEST DATA (blows/ft) 10 20 30 60 80	N VALUE
50		3 in. x 30 in. undisturbed "Shelby tube" pushed 48 - 50 ft.; 21 in. recovery, w = 26%, fines = 94%, LL = 57, PI = 35, unit weight = 119pcf		-28.9	U-9		
55		- - - stiff, reddish brown and gray mottled, slight sand content, PP = 2.0, TV = 1.0		-33.9	U-10		
		SILT (MH/ML) very stiff, bluish gray and olive mottled, some clay content, PP = 3.0, TV = 1.0		-38.9	U-11		
60				-43.9	U-12		
65		- - - brownish gray and bluish gray, PP = 2.5, TV = 0.4		-48.9	U-13		
		CLAY (CH) very stiff, olive and grayish brown mottled, some silt content, PP = 3.0, TV = 1.0		-53.9	U-14		
70							
75		- - -, PP = 2.5, TV = 0.7 BORING TERMINATED AT 75 FEET					

BORING LOG 99588.GPJ S&ME.GDT 11/10/99

1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

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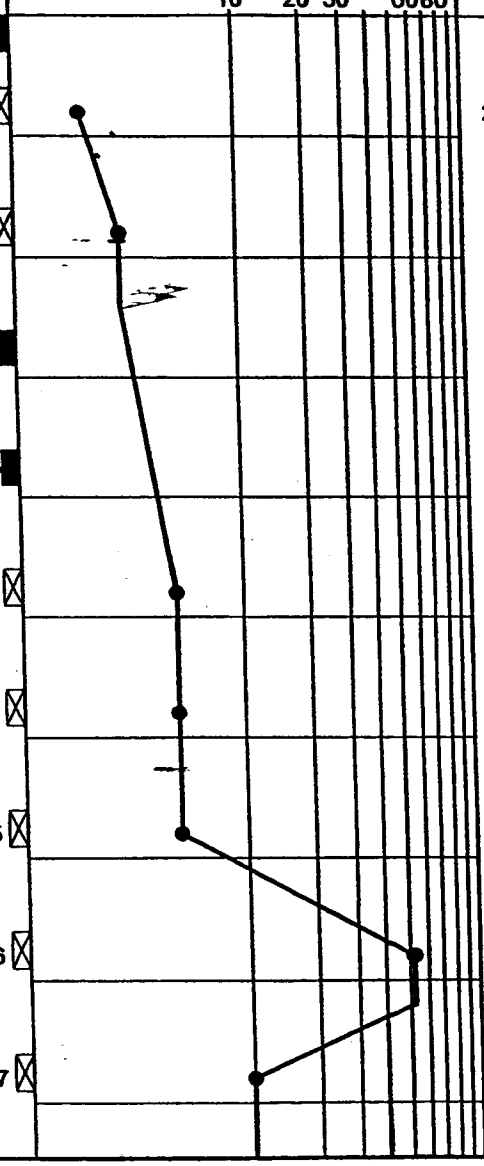
PROJECT: SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588		BORING LOG C-2
DATE DRILLED: 9/8/99	ELEVATION: 17.0	NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevation referenced NAVD '88
DRILLING METHOD: Mud Rotary	BORING DEPTH: 89.5 feet	
LOGGED BY: GREG	WATER LEVEL:9.5 ft. after 24 hrs.	
DRILLER: VAN & SONS	DRILL RIG: FAILING-36	

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	SAMPLE NO/TYPE	N VALUE
	CLAY (CL/CH) hard, brown, slight root content, moist, PP = >5.0		UD-1	
5	- - - very soft, black, very moist, slight sand content, hydrocarbon odor; w = 22%	12.0	S-1	2
	CLAY (CH) soft, grayish brown and olive mottled, PP = 1.0, w = 37%		S-2	3
10		7.0		
	CLAYEY SAND (SC) very loose, grayish brown, fine; very clayey with root content to slightly clayey with depth		UD-2	
15		2.0		
	CLAY (CL) 3 in. x 30 in. undisturbed "Shelby tube" pushed 18 - 20 ft.; 22 in. recovery, w =42%, fines = 94%, LL = 42, PI = 22, Unit weight = 93 pcf		UD-3	
20	**SLIGHTLY SILTY SAND (SP-SM)** loose, grayish brown, fine	-3.0		
25		-8.0	S-3	5
	CLAYEY SAND (SC) loose, grayish brown, fine; w = 31%, fines = 43%		S-4	5
30		-13.0		
35	- - - gray	-18.0	S-5	5
	SLIGHTLY SILTY SAND (SP-SM) very dense, gray, fine		S-6	52
40		-23.0		
	CLAY (CH) stiff, gray and brown mottled, PP = 2.25		S-7	10
45		-28.0		

WATER LEVEL

STANDARD PENETRATION TEST DATA (blows/ft)



BORING LOG 99588.GPJ S&ME.GDT 11/10/99

1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

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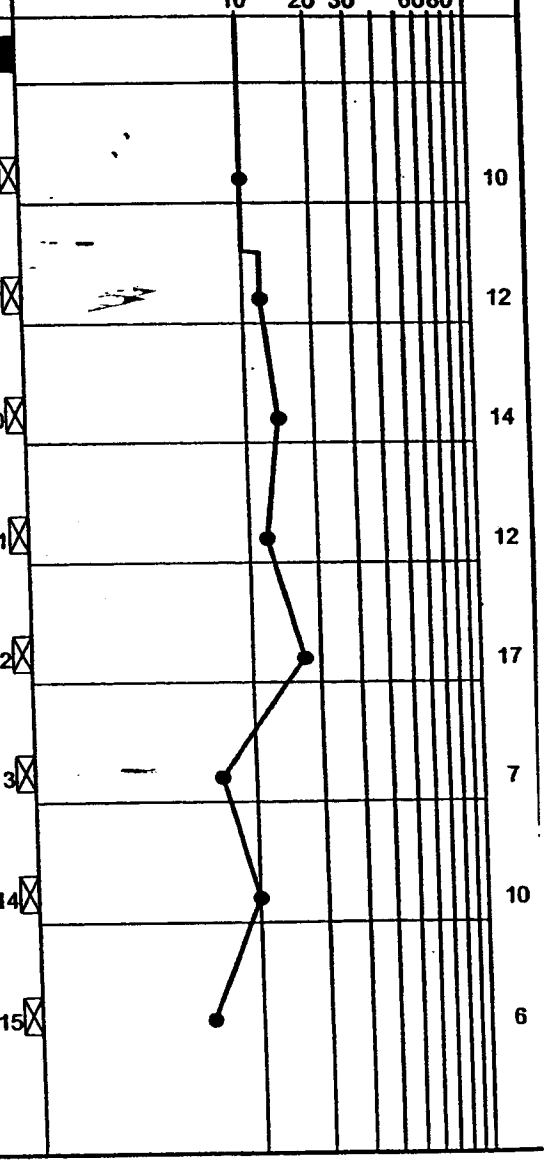
PROJECT:	SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588	BORING LOG C-2
DATE DRILLED: 9/8/99		NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevation referenced NAVD '88
DRILLING METHOD: Mud Rotary		
LOGGED BY: GREG	9.5 ft. after 24 hrs.	
DRILLER: VAN & SONS		

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO/TYPE	STANDARD PENETRATION TEST DATA (blows/ft)	N VALUE
		--- 3 in. x 30 in. undisturbed "Shelby tube" pushed 48 - 50 ft.			UD-4		
50				-33.0			
					S-8		10
55		--- silty, bluish green with trace olive mottling, slight sand content, PP = 1.75, w = 25%		-38.0			
		CLAY (CL) stiff, brownish gray, brown and dark brown mottled, slight sand and clay content, PP = 1.25, w = 29%, LL = 30, PI = 12			S-9		12
60				-43.0			
					S-10		14
65		--- brownish gray and olive, PP = 2.0		-48.0			
		CLAY (CH) stiff, gray and olive, PP = 2.5			S-11		12
70				-53.0			
					S-12		17
75		--- grayish brown, very stiff, PP = 1.75		-58.0			
					S-13		7
80		--- firm, dark gray, PP = 1.0, w = 38%		-63.0			
					S-14		10
85		--- stiff, low recovery, PP = 1.5		-68.0			
					S-15		6
		--- firm, brownish gray, PP = 0.75 BORING TERMINATED AT 89.5 FEET					



1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

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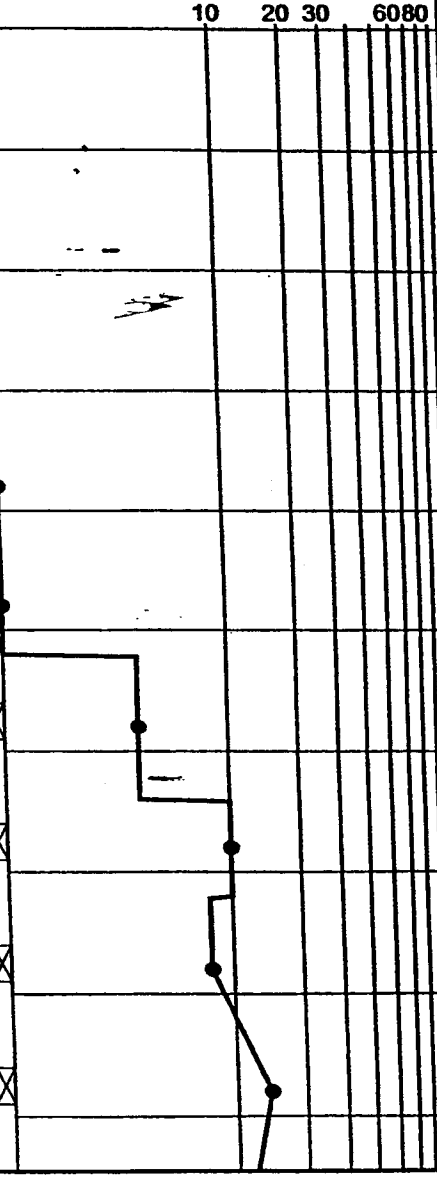
PROJECT: SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588		BORING LOG C-6
DATE DRILLED: 9/10/99	ELEVATION: 15.6	NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevation referenced NAVD '88
DRILLING METHOD: Mud Rotary	BORING DEPTH: 89.5 feet	
LOGGED BY: GREG	WATER LEVEL:7 ft. after 24 hrs.	
DRILLER: VAN & SONS	DRILL RIG: FAILING-36	

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	SAMPLE NO/TYPE	N VALUE
	CLAY (CH/CL) very stiff, dark brown, slight sand and root content, moist		UD-1	
	- - - soft, very moist, low recovery, w = 15%	10.6	S-1	2/ 18 in
5	**VERY SANDY CLAY (CH/SC)** very loose, black, fine; low recovery, w = 41%, fines = 69%			
		5.6	S-2	1/ 18 in
10				
			UD-2	
15	3 x 30 in. undisturbed "Shelby tube" pushed 13 to 15', hydrocarbon odor	0.6		
		-4.4	S-3	2/ 18 in.
20	- - - interbedded sand and clay			
	CLAYEY SAND (SC) very loose, gray, fine; w = 33%, fines = 36%	-9.4	S-4	woh
25	**CLAY (CH)** soft, olive, trace sand content, w = 29%			
		-14.4	S-5	4
30	**SLIGHTLY CLAYEY SAND (SP-SC)** loose, brownish gray, fine, slight silt content			
		-19.4	S-6	10
35	**CLAY (CH)** stiff, gray with trace reddish brown mottling, PP = 1.5, w = 38%			
		-24.4	S-7	8
40				
		-29.4	S-8	14
45	- - - very stiff, reddish brown and bluish gray mottled, PP = 2.0			

STANDARD PENETRATION TEST DATA (blows/ft)



1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

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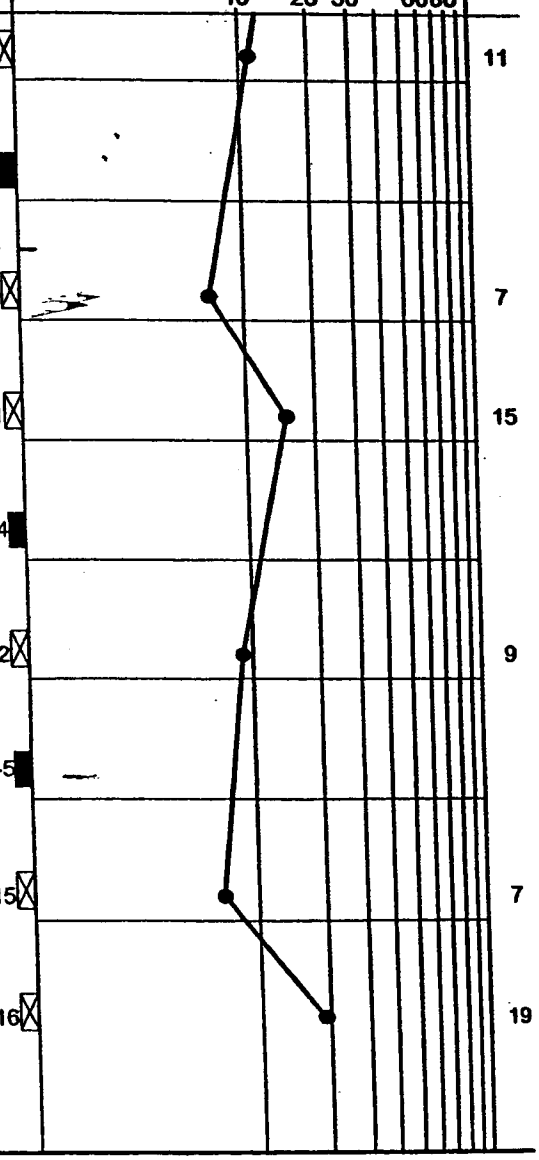
BORING LOG 99588.GPJ S&ME.GDT 11/10/99

PROJECT: SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588		BORING LOG C-6
DATE DRILLED: 9/10/99	ELEVATION: 15.6	NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevation referenced NAVD '88
DRILLING METHOD: Mud Rotary	BORING DEPTH: 89.5 feet	
LOGGED BY: GREG	WATER LEVEL:7 ft. after 24 hrs.	
DRILLER: VAN & SONS	DRILL RIG: FAILING-36	

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO/TYPE	STANDARD PENETRATION TEST DATA (blows/ft)	N VALUE
50		--- PP = 2.5, 12 inch clayey sand layer from 48' to 49'		-34.4	S-9		11
					UD-3		
55		--- (CH/CL), slight silt content, TV = 0.8		-39.4			
					S-10		7
60		--- (CH), firm, w = 29%		-44.4			
					S-11		15
65		--- stiff, olive and bluish gray, PP = 2.25		-49.4			
					UD-4		
70		--- very stiff, PP = 3.5, TV = 0.9		-54.4			
					S-12		9
75		--- stiff, dark gray, PP = 1.75		-59.4			
					UD-5		
80		--- firm, PP = 1.0, w = 57%		-64.4			
					S-15		7
85		--- very stiff, bluish gray, trace sand seams with shell, trace organic content, PP = 2.25, TV = 1.4		-69.4			
		--- very stiff, slight organic content, PP = 1.5			S-16		19
		BORING TERMINATED AT 89.5 FEET					



BORING LOG 99588.GPJ S&ME.GDT 11/10/99

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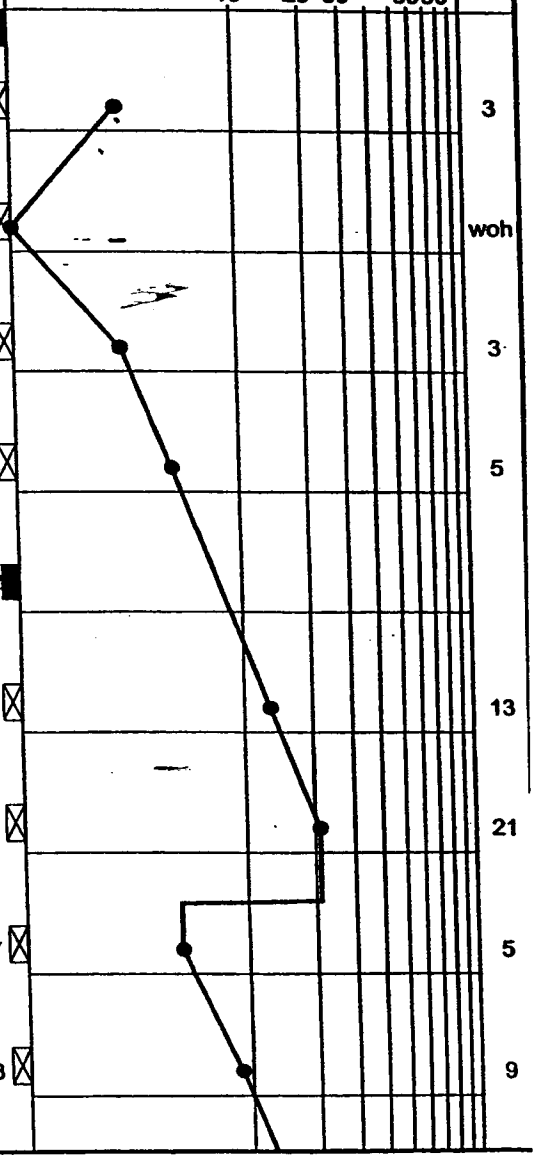
PROJECT: SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588		BORING LOG C-7
DATE DRILLED: 9/10/99	ELEVATION: 15.0	NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevation referenced NAVD '88
DRILLING METHOD: Mud Rotary	BORING DEPTH: 74.5 feet	
LOGGED BY: GREG	WATER LEVEL: 6 ft. after 24 hrs.	
DRILLER: VAN & SONS	DRILL RIG: FAILING-36	

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	SAMPLE NO/TYPE	N VALUE
	CLAY (CH/CL) brown, hard, moist, slight root content, PP = 5.0		UD-1	
			S-1	3
5	--- soft, brown, very moist			
	CLAY (CH) very soft, black, hydrocarbon odor, w = 58%, fines = 93%	10.0		
			S-2	woh
10		5.0		
			S-3	3
15	--- grayish brown sand seams, w = 46%, fines = 86%	0.0		
			S-4	5
20	--- firm	-5.0		
	3 x 30 in. "Shelby tube" pushed 23 - 25', 22 in. recovery		UD-2	
25		-10.0		
	SLIGHTLY CLAYEY SAND (SP-SC) medium dense, gray, fine		S-5	13
30		-15.0		
	SLIGHTLY SILTY SAND (SP-SM) medium dense, gray, fine, low recovery		S-6	21
35		-20.0		
	CLAY (CH) firm, gray with slight reddish brown, PP = 0.75, w = 43%		S-7	5
40		-25.0		
			S-8	9
45	--- stiff, with reddish brown, PP = 1.75	-30.0		

WATER LEVEL

STANDARD PENETRATION TEST DATA (blows/ft)



BORING LOG 99588.GPJ S&ME.GDT 11/10/99

1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

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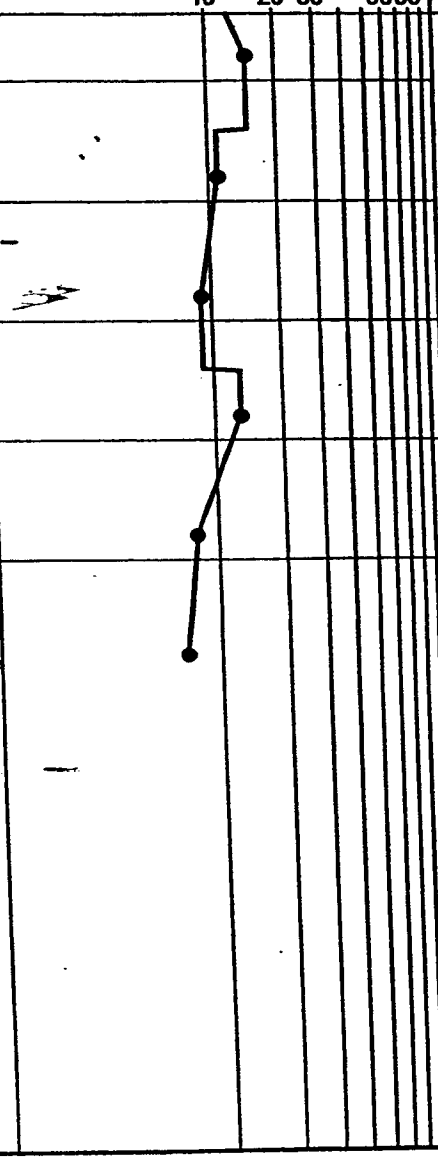
PROJECT: SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588		BORING LOG C-7
DATE DRILLED: 9/10/99	ELEVATION: 15.0	NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevation referenced NAVD '88
DRILLING METHOD: Mud Rotary	BORING DEPTH: 74.5 feet	
LOGGED BY: GREG	WATER LEVEL: 6 ft. after 24 hrs.	
DRILLER: VAN & SONS	DRILL RIG: FAILING-36	

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO/TYPE	STANDARD PENETRATION TEST DATA (blows/ft)	N VALUE
50		- - - PP = 2.0		-35.0	S-9		15
		CLAY (CL) stiff, olive brown and gray mottled, PP = 1.0					
55				-40.0	S-10		11
60		- - - PP = 0.75, w = 31%, LL = 34, PI = 18		-45.0	S-11		9
		CLAY (CH) stiff, gray and olive, PP = 1.75					
65				-50.0	S-12		13
70		- - - firm, PP = 1.75, w = 44%		-55.0	S-13		8
		- - - dark gray, PP = 1.25			S-14		7
		BORING TERMINATED AT 74.5 FEET					



BORING LOG 99588.GPJ S&ME.GDT 11/10/99

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.
2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

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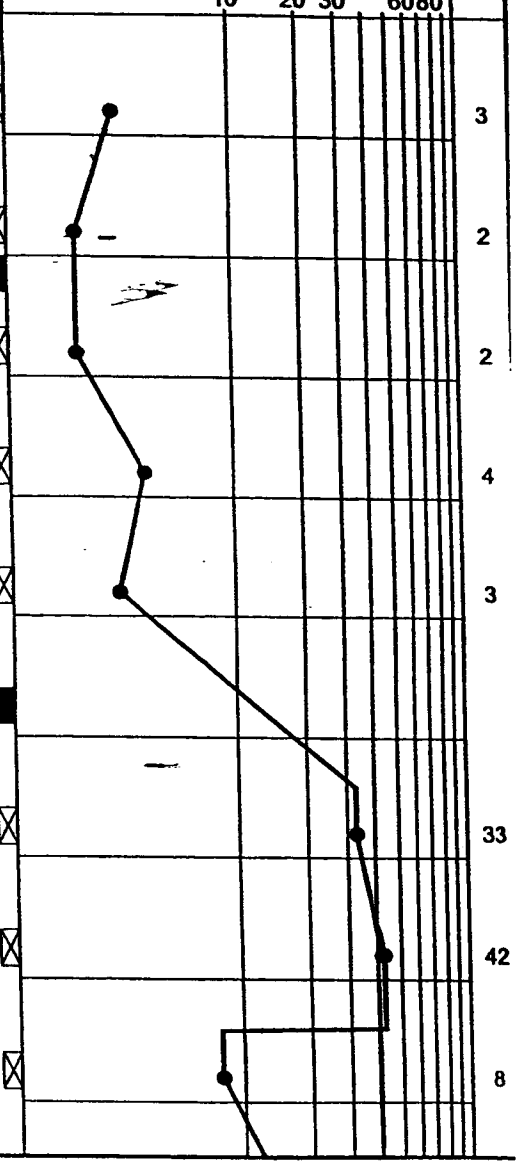
PROJECT: SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588	BORING LOG C-8
DATE DRILLED: 9/9/99	ELEVATION: 16.3
DRILLING METHOD: Mud Rotary	BORING DEPTH: 75.0 feet
LOGGED BY: GREG	WATER LEVEL: 6.5 ft. after 24 hrs.
DRILLER: VAN & SONS	DRILL RIG: FAILING-36

NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevation referenced NAVD '88

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	SAMPLE NO/TYPE	N VALUE
	CLAY (CH/CL) hard, brown, slight root content, dry, PP = 5.0		UD-1	
			S-1	3
5	- - - soft, moist to wet, w = 23%	11.3		
	CLAY (CH) very soft, black and brownish gray, slight sand content, hydrocarbon odor, w = 44%			
			S-2	2
10	**CLAYEY SAND (SC)** olive brown, fine, clay lenses in split spoon 3 x 30 in. undisturbed "Shelby tube" pushed 10 to 12', no recovery	6.3	UD-2	
	SANDY CLAY (CH) very soft, olive brown, sand seams, w = 38%, fines = 77%		S-3	2
15		1.3		
			S-4	4
20	- - - (CH/SC), gray, very sandy	-3.7		
			S-5	3
25	- - - (CH), alternating zones of sandy clay and clayey sand, w = 55%, fines = 87%	-8.7		
	SANDY CLAY (CL) 3 x 30 in. undisturbed "Shelby tube" pushed 28 - 30', w = 31%, fines = 60%, LL = 33, PI = 18'		UD-3	
30		-13.7		
	SLIGHTLY CLAYEY SAND (SP-SC) dense, gray, dark brown, fine		S-6	33
35		-18.7		
	SLIGHTLY SILTY SAND (SP-SM) dense, light brown, fine		S-7	42
40		-23.7		
	CLAY (CH) firm, brownish gray and reddish brown mottled, PP = 1.25, w = 39%		S-8	8
45		-28.7		

STANDARD PENETRATION TEST DATA (blows/ft)



BORING LOG 99558.GPJ S&ME.GDT 11/10/99

1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

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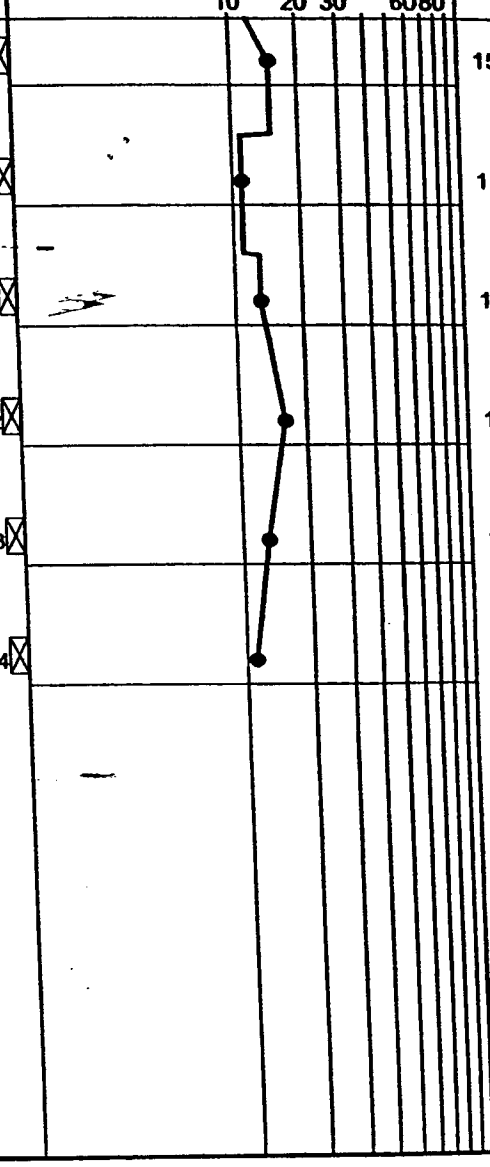
PROJECT:	SHOAL POINT TERMINAL TEXAS CITY, TEXAS 1131-99-588	BORING LOG C-8
DATE DRILLED: 9/9/99	ELEVATION: 16.3	NOTES: PP = Pocket Penetrometer (TSF), TV = Torvane (TSF), w = natural moisture content, fines = % passing #200 sieve, Elevation referenced NAVD '88
DRILLING METHOD: Mud Rotary	BORING DEPTH: 75.0 feet	
LOGGED BY: GREG	WATER LEVEL: 6.5 ft. after 24 hrs.	
DRILLER: VAN & SONS	DRILL RIG: FAILING-36	

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO/TYPE	STANDARD PENETRATION TEST DATA (blows/ft)	N VALUE
50		- - - stiff, PP = 2.25		-33.7	S-9		15
		CLAYEY SILT (MH) stiff, bluish gray and olive brown mottled, PP = 2.25, w = 25%		-38.7	S-10		11
55		SILTY CLAY (CH) stiff, bluish gray, grayish brown and olive mottled, slight sand content		-43.7	S-11		13
60				-48.7	S-12		16
65		- - - very stiff, olive, trace sand, PP = 2.25		-53.7	S-13		13
70		- - - stiff, gray with slight olive mottling, PP = 2.25		-58.7	S-14		11
75		- - - gray, PP = 1.25, w = 51% BORING TERMINATED AT 75 FEET					



BORING LOG 99588.GPJ S&ME.GDT 11/10/99

1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

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FIELD TESTING PROCEDURES

Soil Classifications

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our exploration, samples obtained during drilling operations are examined and visually classified according to color, texture, and relative density or consistency (based on standard penetration resistance). The consistency and relative density designations are as follows:

SANDS		SILTS AND CLAYS	
N (SPT)	Relative Density	N (SPT)	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
		9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
50+	Very Dense	31 - 50	Hard
		50+	Very Hard

Soil Test Borings

All boring and sampling operations were conducted in accordance with ASTM Designation D-1586. Initially, the borings were advanced by either mechanically augering or wash boring through the soils. Where necessary, a heavy drilling fluid is used below the water table to stabilize the side and bottom of the drill hole. At regular intervals soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140 pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Standard Penetration Resistance". The penetration resistance, when properly evaluated, is an index to the soil strength.

Undisturbed Sampling

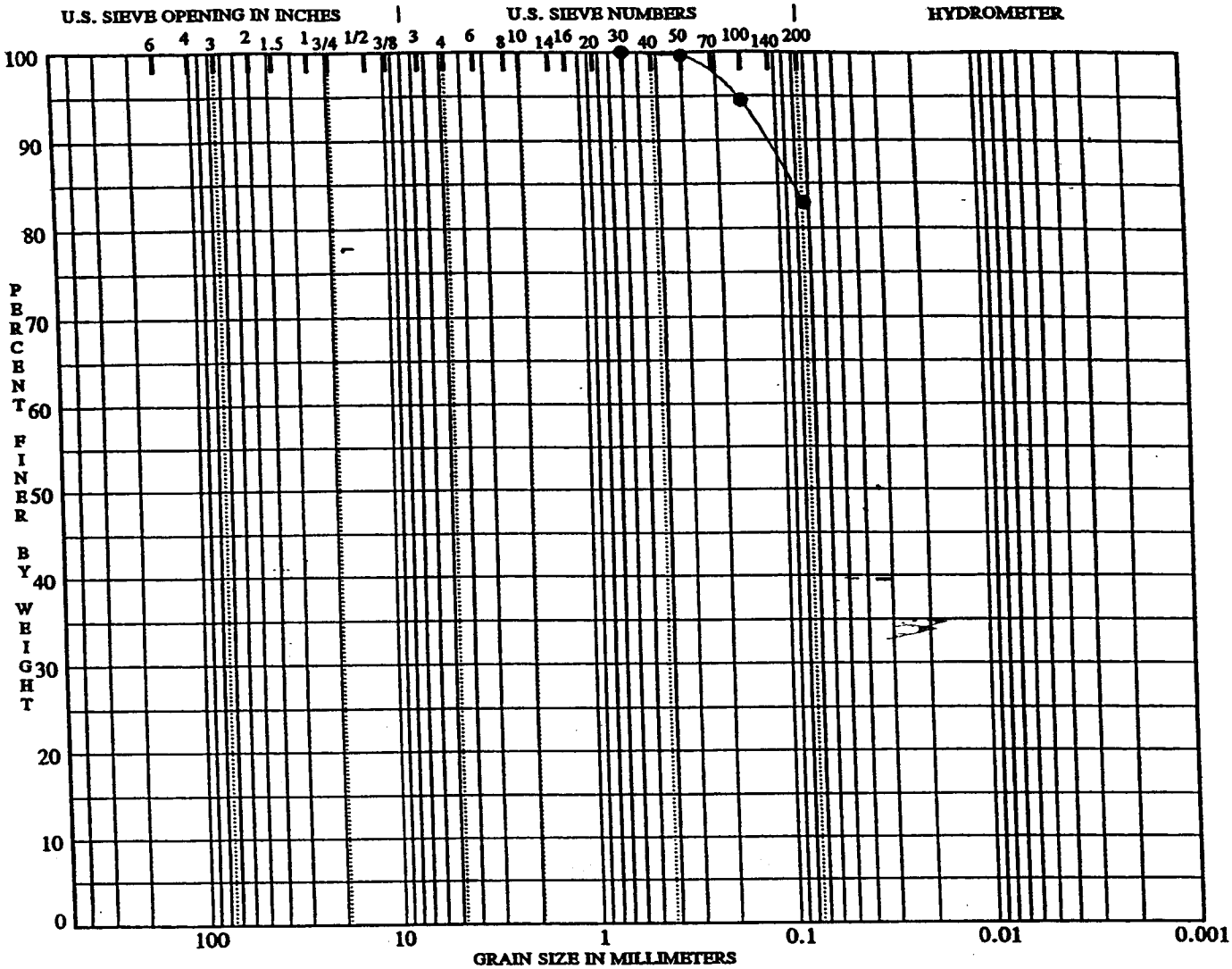
The split-barrel samples obtained during the penetration testing are available for visual examination and routine classification tests, but are not sufficiently intact for more quantitative laboratory testing. Consequently, undisturbed samples were obtained by forcing 30-inch long, 3-inch O.D. thin walled steel tube into the soil at the desired sampling level. This sampling procedure is described by ASTM Specification D-1587. After removing the sampler from the borehole, the ends are scraped to remove loose soils and sealed with microcrystalline wax. The undisturbed samples were then returned to the laboratory for testing.

APPENDIX III

SOIL DATA SUMMARY

INDIVIDUAL LABORATORY DATA SHEETS
GRADATION CURVES
ATTERBERG LIMITS
CONSOLIDATION

LABORATORY TESTING PROCEDURES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
● C-8	13.0		38					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● C-8	13.0	0.60				0.0	17.0	83.0	

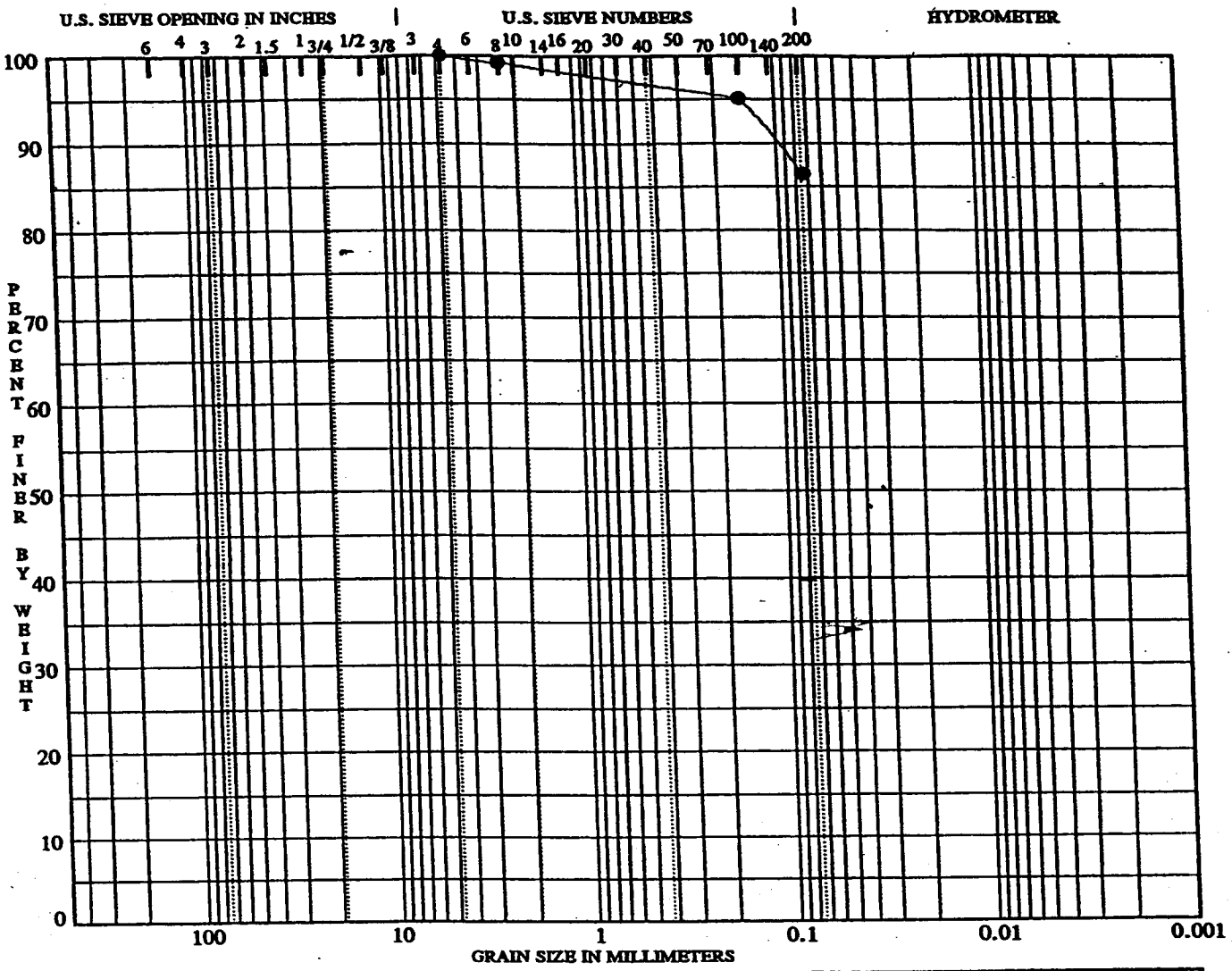
PROJECT Shoal Point Terminal -

JOB NO. 1131-99-588
DATE 9/27/99

S & ME, INC.

GRADATION CURVES

840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
● C-8	21.0		55					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● C-8	21.0	4.75				0.0	13.4	86.6	

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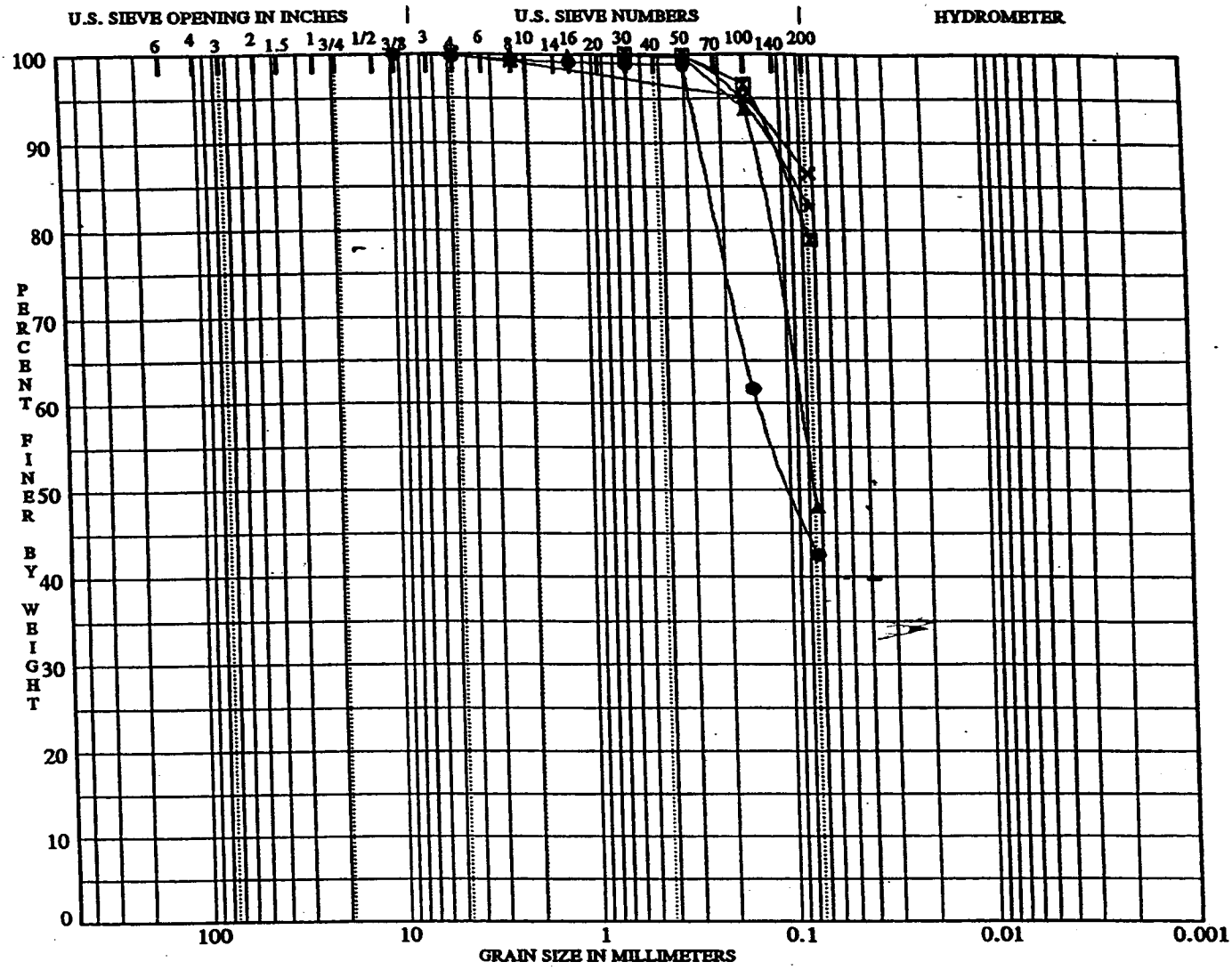
S & ME, INC.
840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA

GRADATION CURVES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	C-2	28.0		31					
⊠	C-3	33.0		25					
▲	C-6	23.0		33					
★	C-8	13.0		38					
✕	C-8	21.0		55					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	C-2	28.0	9.52	0.14			0.3	56.8	42.9	
⊠	C-3	33.0	0.60				0.0	20.9	79.1	
▲	C-6	23.0	2.36	0.09			0.0	51.1	48.9	
★	C-8	13.0	0.60				0.0	17.0	83.0	
✕	C-8	21.0	4.75				0.0	13.4	86.6	

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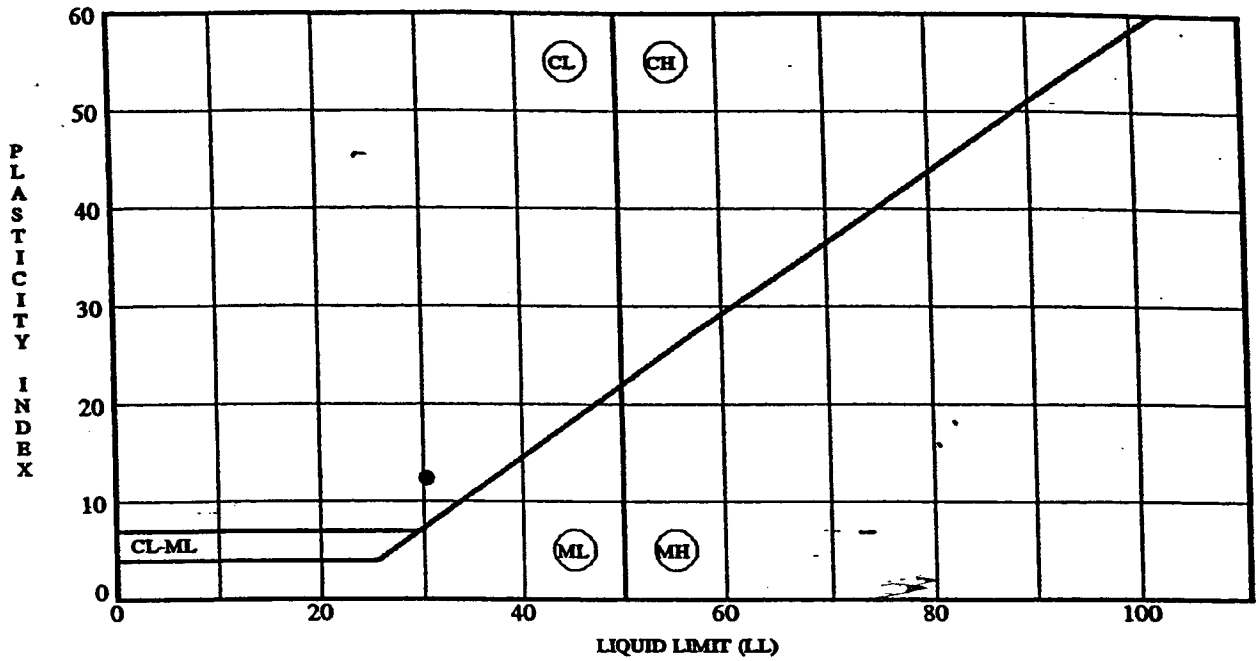
DATE 9/27/99

S & ME, INC.

GRADATION CURVES

840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	C-2	58.0	30	18	12		

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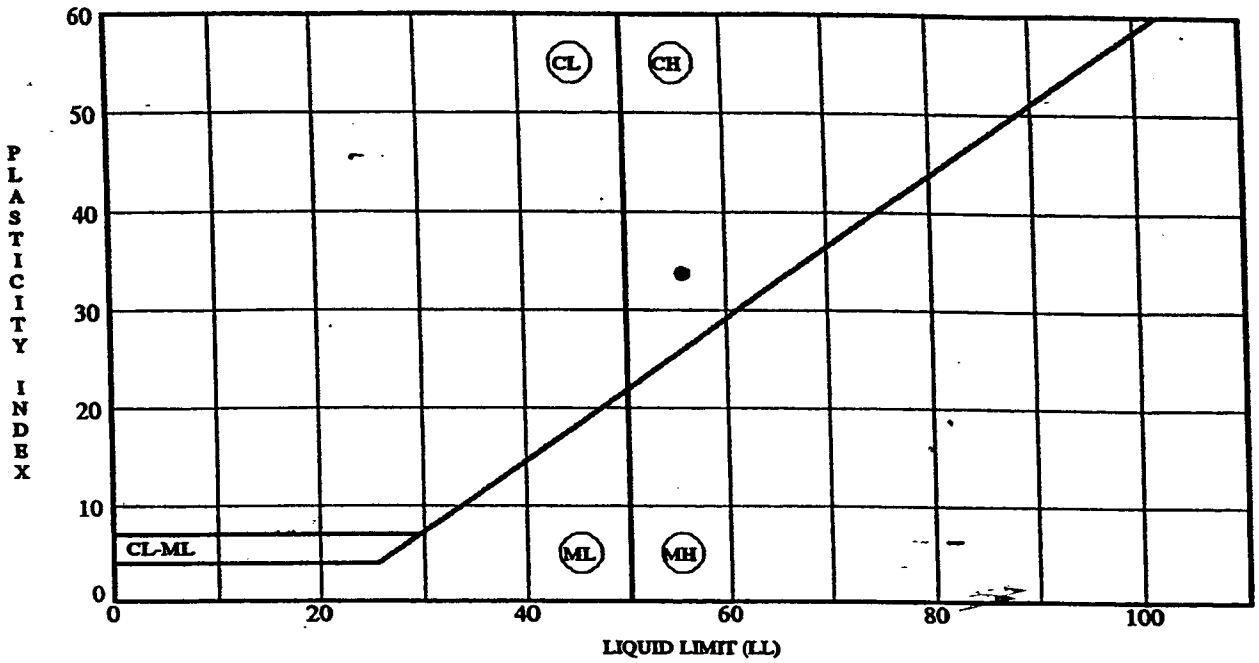
JOB NO. 1131-99-588
DATE 9/27/99

S & ME, INC.ATTERBERG LIMITS' RESULTS

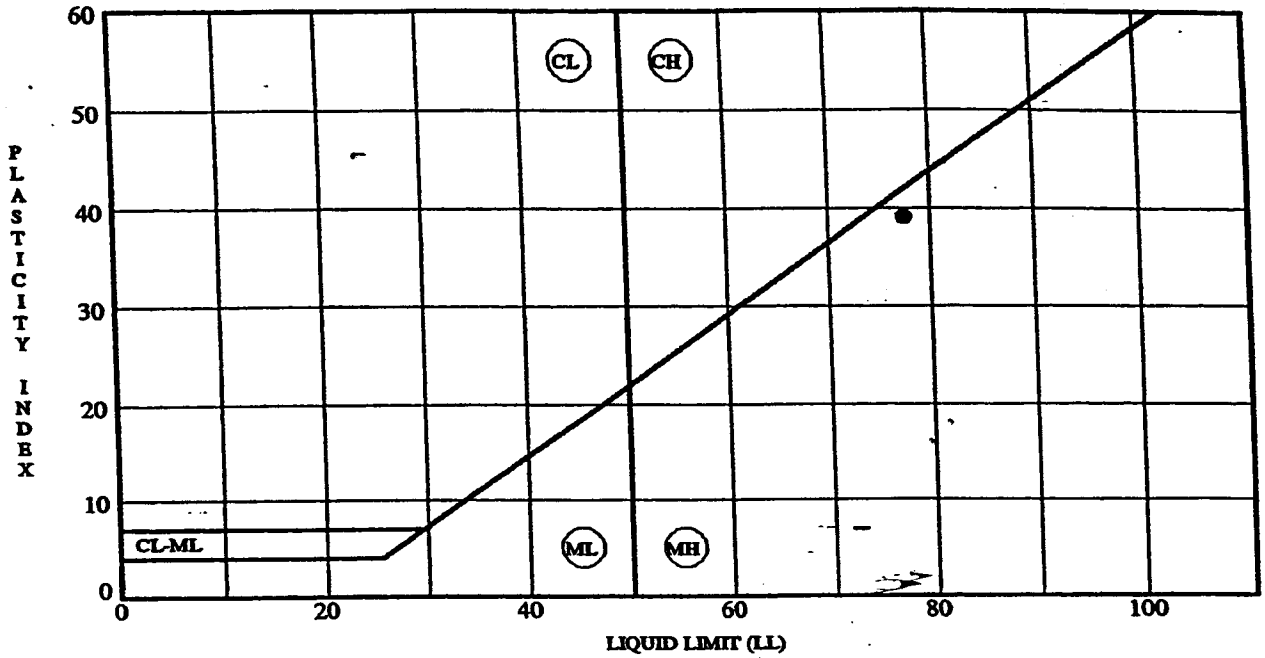
840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	C-3	73.0	56	22	34		

PROJECT Shoal Point Terminal - JOB NO. 1131-99-588
DATE

S & ME, INC.ATTERBERG LIMITS' RESULTS
840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	C-4	4.0	78	38	39		

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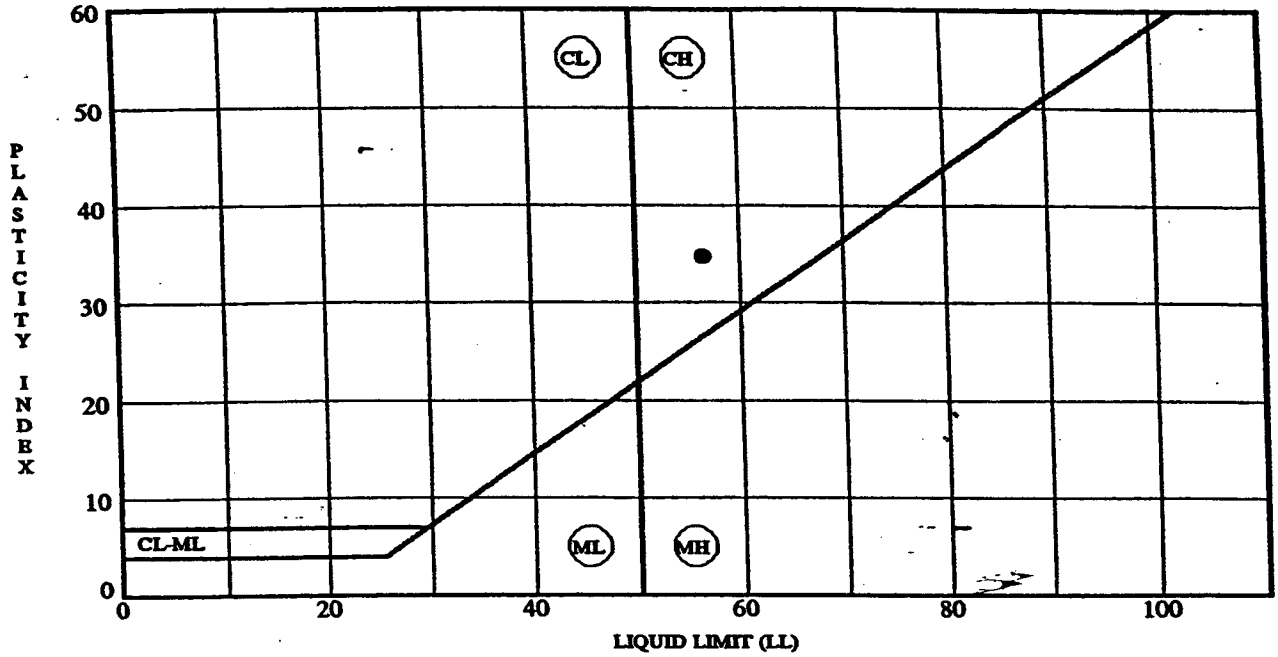
DATE

S & ME, INC.ATTERBERG LIMITS' RESULTS

840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	C-5	13.0	57	22	35		

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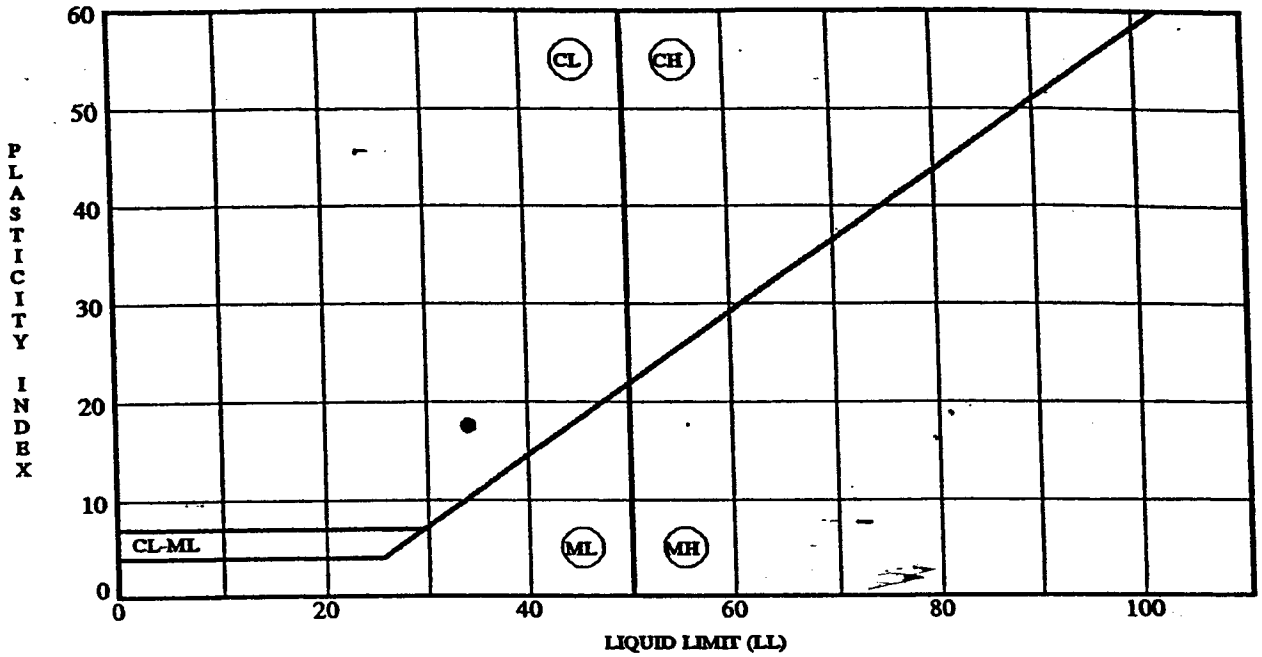
S & ME, INC.ATTERBERG LIMITS' RESULTS

840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	C-7	58.0	34	17	18		

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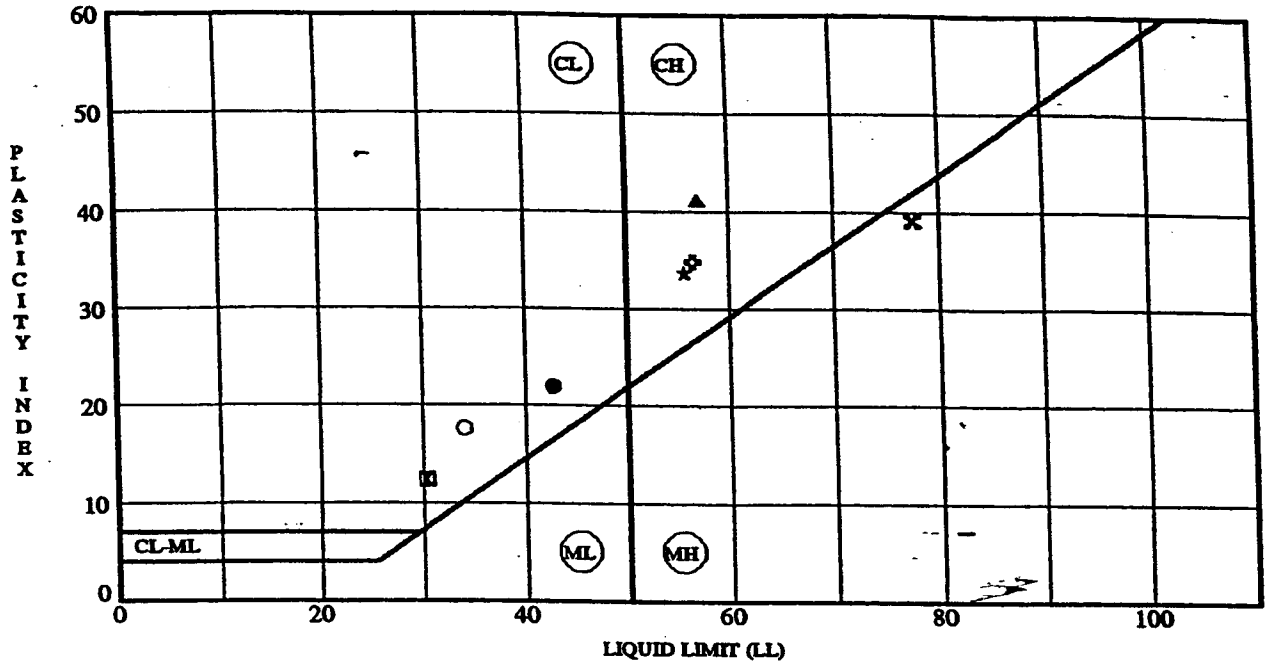
DATE 9/27/99

S & ME, INC.ATTERBERG LIMITS' RESULTS

840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	C-2	18.0	43	21	22		
⊠	C-2	58.0	30	18	12		
▲	C-3	13.0	57	16	41		
★	C-3	73.0	56	22	34		
✕	C-4	4.0	78	38	39		
✿	C-5	13.0	57	22	35		
○	C-7	58.0	34	17	18		

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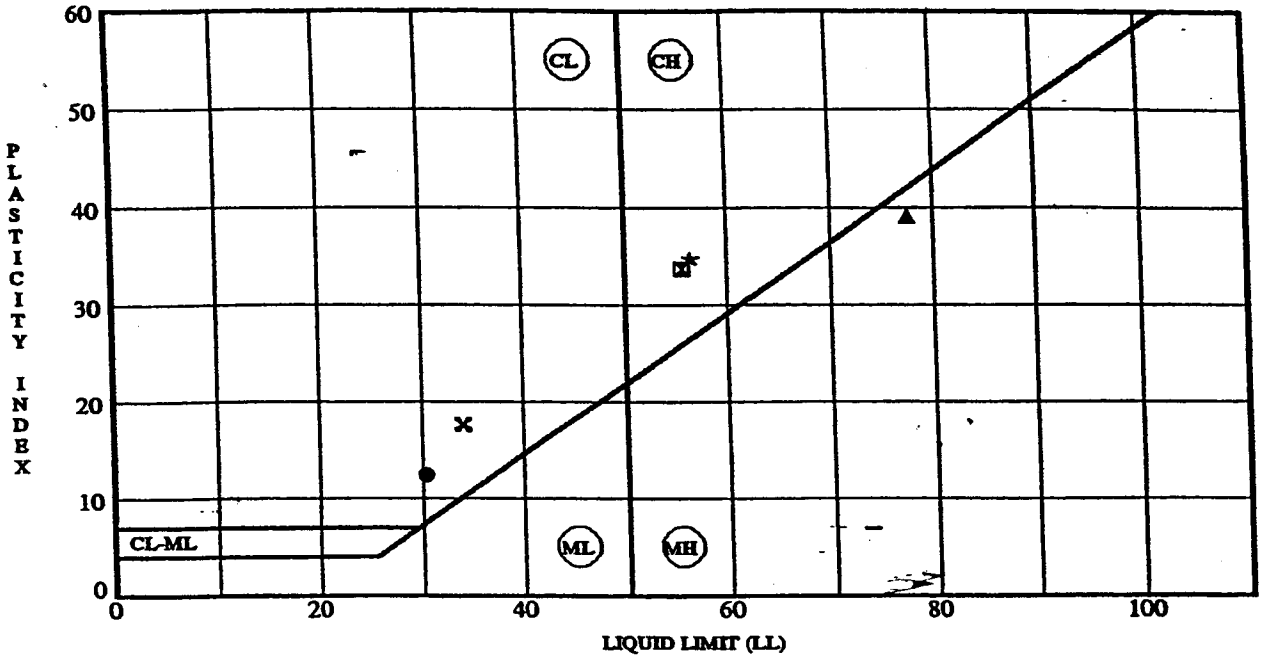
S & ME, INC.ATTERBERG LIMITS' RESULTS

840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	C-2	58.0	30	18	12		
⊠	C-3	73.0	56	22	34		
▲	C-4	4.0	78	38	39		
★	C-5	13.0	57	22	35		
✕	C-7	58.0	34	17	18		

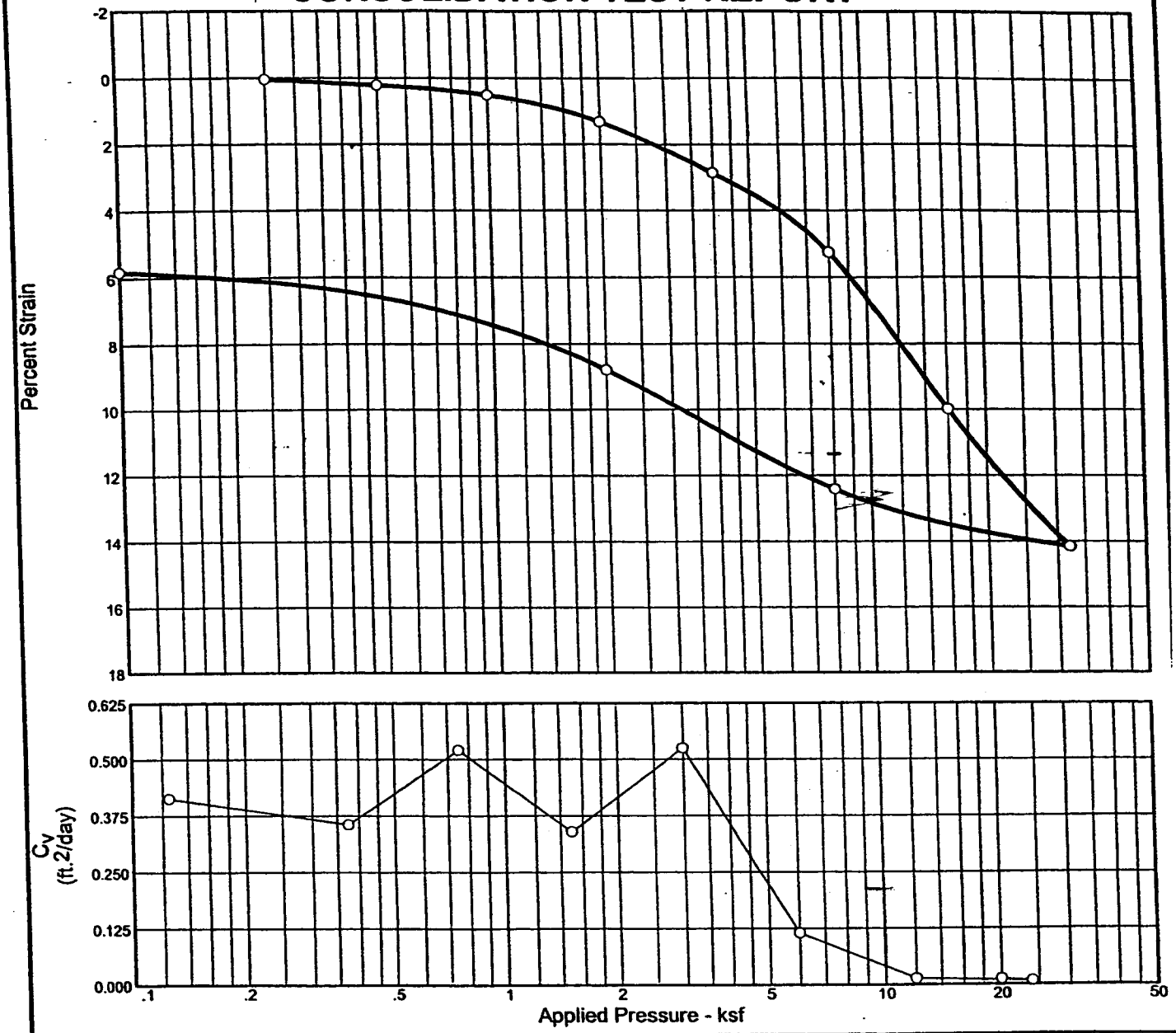
PROJECT Shoal Point Terminal -

JOB NO. 1131-99-588
DATE 9/27/99

S & ME, INC.ATTERBERG LIMITS' RESULTS

840 LOW COUNTRY BOULEVARD
CHARLESTON, SOUTH CAROLINA

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Swell %	e_o
89.8 %	25.8 %	94.3	56.5	34.5	2.67		7.38	0.27	0.07			0.768

MATERIAL DESCRIPTION	USCS	AASHTO
Grey-Blue		

Project No. 1131-99-588 **Client:**

Project:

Source: C-1 **Sample No.:** C-1 **Elev./Depth:** 48-50 ft.

Remarks:
93.5% Passing # 200 sieve

CONSOLIDATION TEST REPORT

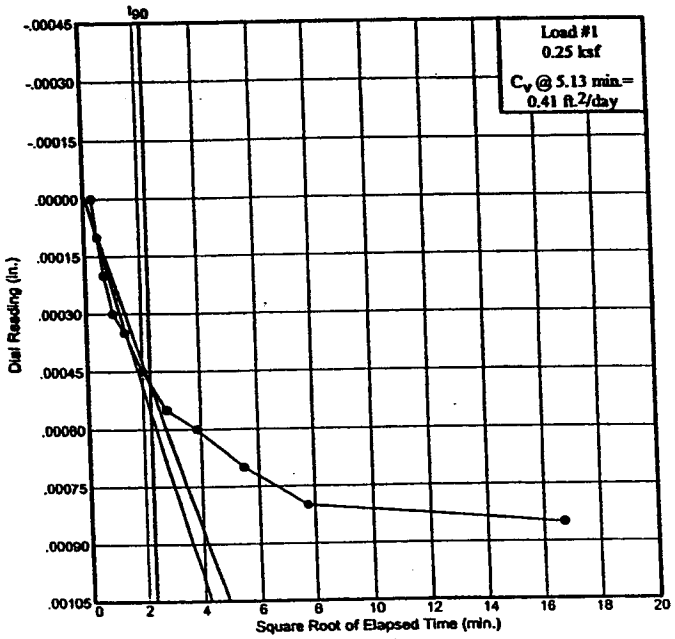
S & ME, Inc.

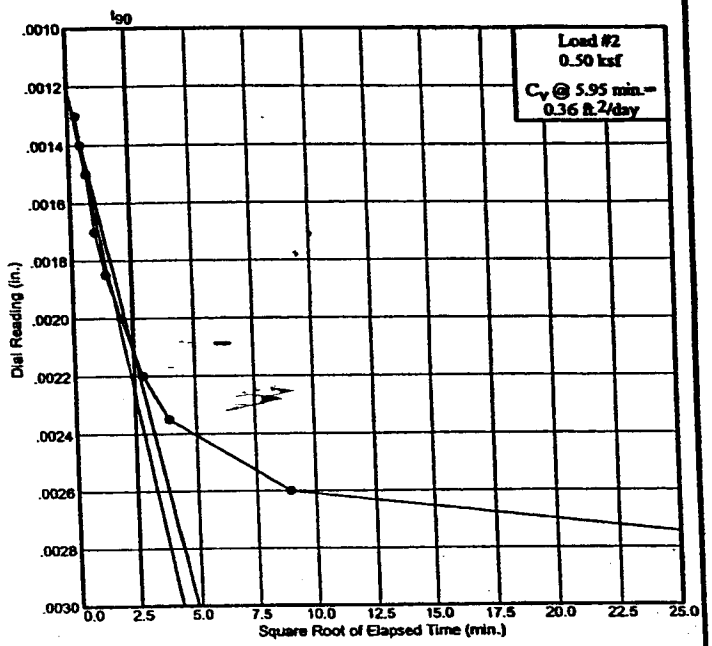
Plate

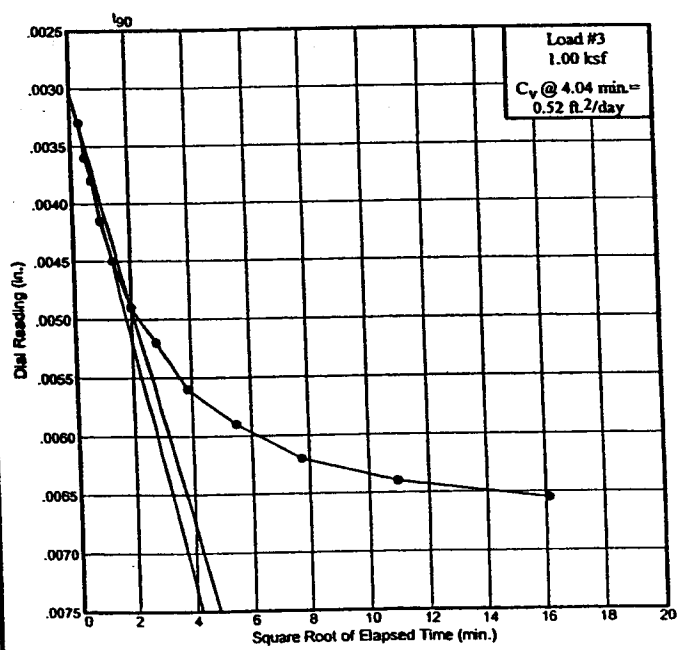
Dial Reading vs. Time

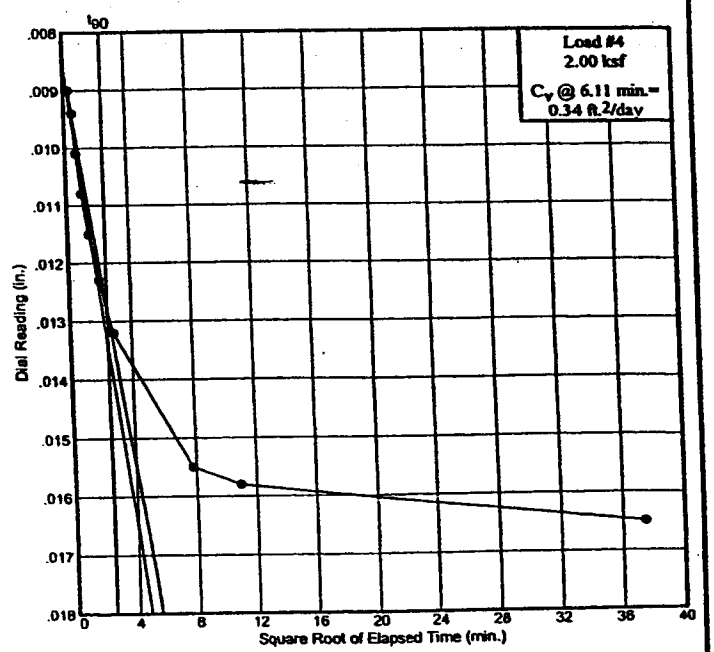
Project No.: 1131-99-588
Project:

Source: C-1 Sample No.: C-1 Elev./Depth: 48-50 ft.









Dial Reading vs. Time

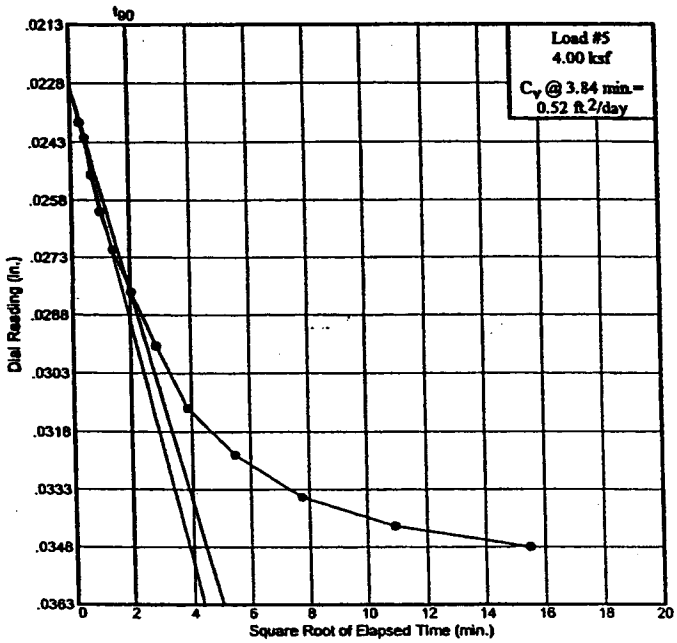
S & ME, Inc.

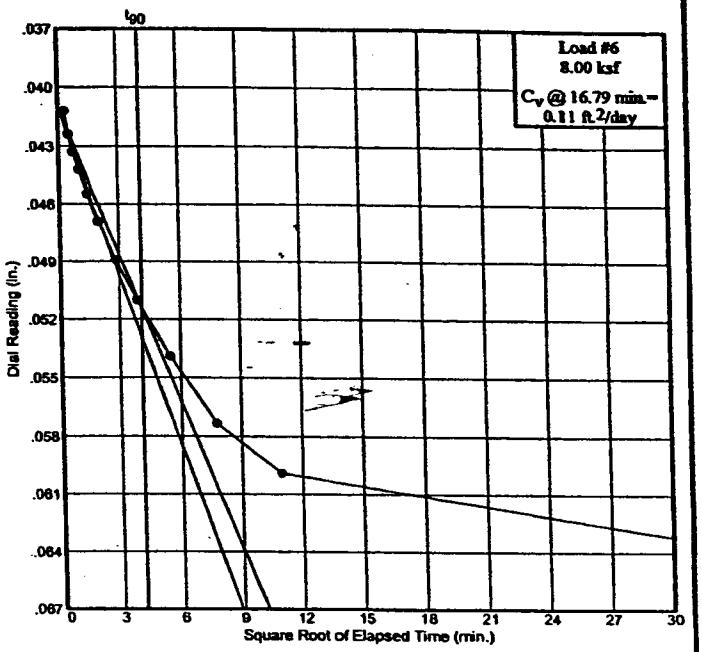
Plate

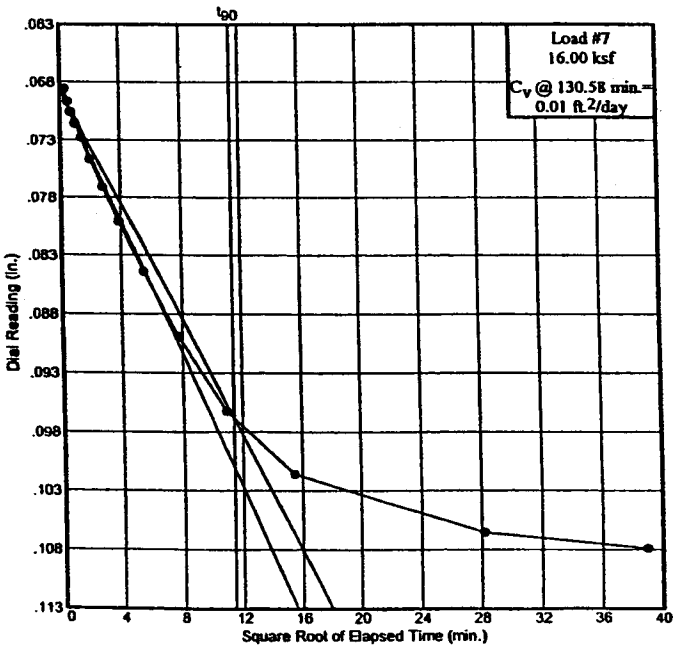
Dial Reading vs. Time

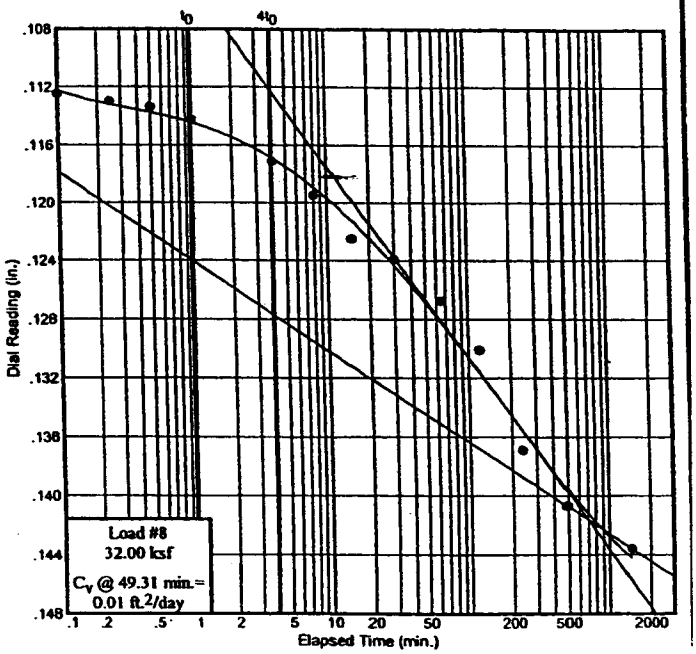
Project No.: 1131-99-588
Project:

Source: C-1 Sample No.: C-1 Elev./Depth: 48-50 ft.









Dial Reading vs. Time

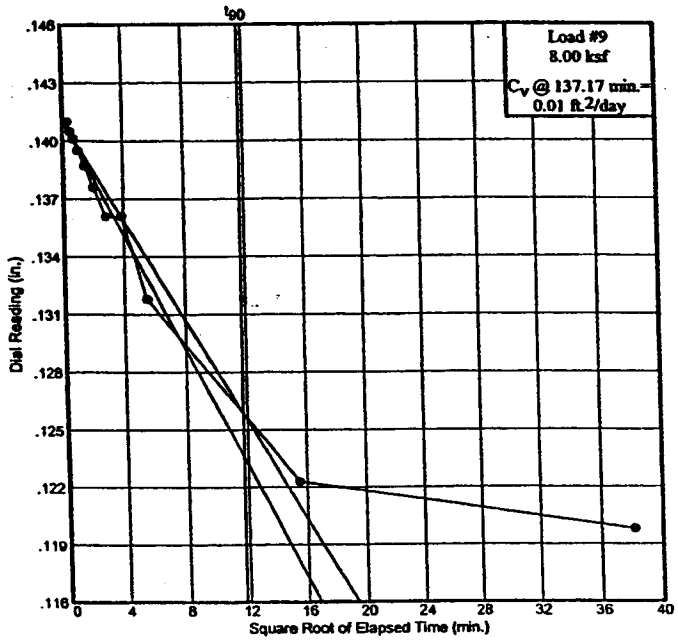
S & ME, Inc.

Plate

Dial Reading vs. Time

Project No.: 1131-99-588
Project:

Source: C-1 Sample No.: C-1 Elev./Depth: 48-50 ft.



Dial Reading vs. Time

S & ME, Inc.

Plate

CONSOLIDATION TEST DATA

ient:
oject:
oject Number: 1131-99-588

Sample Data

urce: C-1
mple No.: C-1
.ev. or Depth: 48-50 ft. Sample Length (in./cm.):
cation:
scription: Stiff,Mottled
.quid Limit: 56.5 Plasticity Index: 34.5
CS: AASHTO: Figure No.:
sting Remarks: 93.5% Passing # 200 sieve

Test Specimen Data

TOTAL SAMPLE		BEFORE TEST	AFTER TEST
t w+t	= 38.50 g.	Consolidometer # = 1	Wet w+t =
y w+t	= 30.60 g.		Dry w+t =
are Wt.	= .00 g.	Spec. Gravity = 2.67	Tare Wt. =
eight	= 1.00 in.	Height = 1.00 in.	
iameter	= 2.50 in.	Diameter = 2.50 in.	
eight	= 152.85 g.	Defl. Table = Reference Set (inches/tsf)	
oisture	= 25.8 %	Ht. Solids = 0.5656 in.	Moisture = %
et Den.	= 118.6 pcf	Dry Wt. = 121.49 g.*	Dry Wt. = n/a
ry Den.	= 94.3 pcf	Void Ratio = 0.768	Void Ratio = 0.665
		Saturation = 89.8 %	

Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	0.00000				0.768	
0.25	0.00125	0.00040	0.41		0.767*	0.1 Comprs.*
0.50	0.00360	0.00080	0.36		0.764*	0.2 Comprs.*
1.00	0.00815	0.00160	0.52		0.759*	0.5 Comprs.*
2.00	0.01890	0.00240	0.34		0.744*	1.3 Comprs.*
4.00	0.03480	0.00000	0.52		0.717*	2.9 Comprs.*
8.00	0.06350	0.00000	0.11		0.675*	5.3 Comprs.*
16.00	0.10790	0.00000	0.01		0.591*	10.0 Comprs.*
32.00	0.14360	0.00000	0.01	0.007	0.518*	14.2 Comprs.*
8.00	0.11980	0.00000	0.01		0.548*	12.4 Comprs.*
2.00	0.08650	0.00300			0.612	8.8 Comprs.
0.10	0.05370	0.00000			0.665	5.8 Comprs.

CALCULATED USING D_{100} INSTEAD OF FINAL READING

$'_c$ = 0.26 P_c = 7.51 ksf C_r = 0.07

Pressure: 0.25 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00000	11	60.00	0.00120
2	0.10	0.00040	12	280.00	0.00125
3	0.25	0.00050			
4	0.50	0.00060			
5	1.00	0.00070			
6	2.00	0.00075			
7	4.00	0.00085			
8	8.00	0.00095			
9	15.00	0.00100			
10	30.00	0.00110			

Void Ratio = 0.767 Compression = 0.1 % >>> CALCULATED USING D_{100}
D_0 = -0.00002 D_{90} = 0.00048 D_{100} = 0.00054
C_v at 5.1 min. = 0.41 ft.^{2}/day

Pressure: 0.50 ksf — **TEST READINGS** — **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00125	11	975.00	0.00360
2	0.10	0.00210			
3	0.25	0.00220			
4	0.50	0.00230			
5	1.00	0.00250			
6	2.00	0.00265			
7	4.00	0.00280			
8	8.00	0.00300			
9	15.00	0.00315			
10	80.00	0.00340			

Void Ratio = 0.764 Compression = 0.2 % >>> CALCULATED USING D_{100}
D_0 = 0.00120 D_{90} = 0.00211 D_{100} = 0.00221
C_v at 5.9 min. = 0.36 ft.^{2}/day

Pressure: 1.00 ksf — **TEST READINGS** — **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00360	11	60.00	0.00780
2	0.10	0.00490	12	120.00	0.00800
3	0.25	0.00520	13	260.00	0.00815
4	0.50	0.00540			
5	1.00	0.00575			
6	2.00	0.00610			
7	4.00	0.00650			
8	8.00	0.00680			
9	15.00	0.00720			
10	30.00	0.00750			

Void Ratio = 0.759 Compression = 0.5 % >>> CALCULATED USING D_{100}
D_0 = 0.00302 D_{90} = 0.00490 D_{100} = 0.00511
C_v at 4.0 min. = 0.52 ft.^{2}/day

essure: 2.00 ksf — TEST READINGS — Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00815	11	1405.00	0.01890
2	0.10	0.01140			
3	0.25	0.01180			
4	0.50	0.01250			
5	1.00	0.01320			
6	2.00	0.01390			
7	4.00	0.01470			
8	8.00	0.01560			
9	60.00	0.01790			
10	120.00	0.01820			

Void Ratio = 0.744 Compression = 1.3 % >>> CALCULATED USING D_{100}
D_0 = 0.00856 D_{90} = 0.01281 D_{100} = 0.01329
C_v at 6.1 min. = 0.34 ft.^{2}/day

ressure: 4.00 ksf — TEST READINGS — Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01890	11	60.00	0.03350
2	0.10	0.02380	12	120.00	0.03425
3	0.25	0.02420	13	240.00	0.03480
4	0.50	0.02515			
5	1.00	0.02610			
6	2.00	0.02710			
7	4.00	0.02820			
8	8.00	0.02960			
9	15.00	0.03120			
10	30.00	0.03240			

Void Ratio = 0.717 Compression = 2.9 % >>> CALCULATED USING D_{100}
D_0 = 0.02282 D_{90} = 0.02812 D_{100} = 0.02871
C_v at 3.8 min. = 0.52 ft.^{2}/day

ressure: 8.00 ksf — TEST READINGS — Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.03480	11	60.00	0.05735
2	0.10	0.04120	12	120.00	0.05990
3	0.25	0.04240	13	1010.00	0.06350
4	0.50	0.04330			
5	1.00	0.04420			
6	2.00	0.04550			
7	4.00	0.04690			
8	8.00	0.04890			
9	15.00	0.05100			
10	30.00	0.05390			

Void Ratio = 0.675 Compression = 5.3 % >>> CALCULATED USING D_{100}
D_0 = 0.04096 D_{90} = 0.05141 D_{100} = 0.05257
C_v at 16.8 min. = 0.11 ft.^{2}/day

Pressure: 16.00 ksf — **TEST READINGS** — **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.06350	11	60.00	0.08990
2	0.10	0.06860	12	120.00	0.09625
3	0.25	0.06970	13	240.00	0.10160
4	0.50	0.07060	14	795.00	0.10655
5	1.00	0.07160	15	1520.00	0.10790
6	2.00	0.07280			
7	4.00	0.07470			
8	8.00	0.07710			
9	15.00	0.08010			
10	30.00	0.08440			

Void Ratio = 0.591 Compression = 10.0 % >>> CALCULATED USING D_{100}
D_0 = 0.06861 D_{90} = 0.09681 D_{100} = 0.09994
C_v at 130.6 min. = 0.01 ft.^{2}/day

Pressure: 32.00 ksf — **TEST READINGS** — **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.10790	11	120.00	0.13010
2	0.10	0.11250	12	240.00	0.13690
3	0.25	0.11300	13	495.00	0.14070
4	0.50	0.11340	14	1460.00	0.14360
5	1.00	0.11425			
6	4.00	0.11715			
7	8.00	0.11950			
8	15.00	0.12250			
9	30.00	0.12390			
10	65.00	0.12675			

Void Ratio = 0.518 Compression = 14.2 % >>> CALCULATED USING D_{100}
D_0 = 0.11198 D_{50} = 0.12679 D_{100} = 0.14161
C_v at 49.3 min. = 0.01 ft.^{2}/day C_α = 0.007

Pressure: 8.00 ksf — **TEST READINGS** — **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.14360	11	240.00	0.12230
2	0.10	0.14100	12	1455.00	0.11980
3	0.25	0.14050			
4	0.50	0.14010			
5	1.00	0.13950			
6	2.00	0.13870			
7	4.00	0.13760			
8	8.00	0.13610			
9	15.00	0.13610			
10	30.00	0.13180			

Void Ratio = 0.548 Compression = 12.4 % >>> CALCULATED USING D_{100}
D_0 = 0.14105 D_{90} = 0.12589 D_{100} = 0.12420
C_v at 137.2 min. = 0.01 ft.^{2}/day

ressure: 2.00 ksf — TEST READINGS — Load No. 10

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.11980	11	60.00	0.10440
2	0.10	0.11780	12	120.00	0.09880
3	0.25	0.11760	13	360.00	0.08650
4	0.50	0.11730			
5	1.00	0.11680			
6	2.00	0.11610			
7	4.00	0.11510			
8	8.00	0.11370			
9	15.00	0.11165			
10	30.00	0.10885			

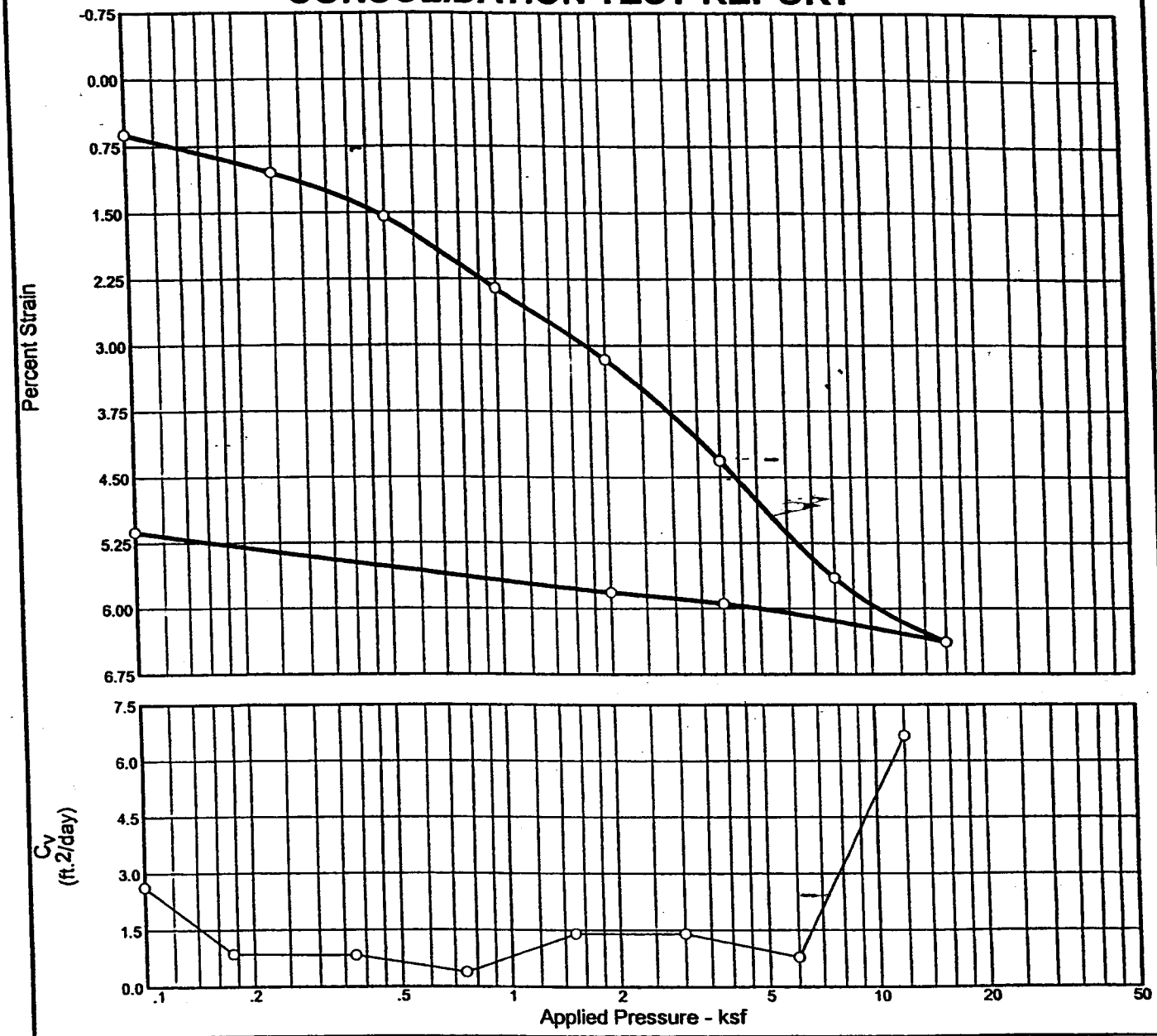
Void Ratio = 0.612 Compression = 8.8 %

ressure: 0.10 ksf — TEST READINGS — Load No. 11

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.08650	11	565.00	0.07310
2	0.10	0.09580	12	1440.00	0.05370
3	0.25	0.08570			
4	0.50	0.08550			
5	1.00	0.08530			
6	2.00	0.08500			
7	4.00	0.08450			
8	8.00	0.08380			
9	15.00	0.08290			
10	60.00	0.07830			

Void Ratio = 0.665 Compression = 5.8 %

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Swell %	e_o
72.9 %	42.2 %	65.5	42.3	21.5	2.67		7.30	0.11	0.01			1.545

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 1131-99-588 **Client:** SHINER MOSELEY and ASSOCIATES

Project: SHOAL POINT TERMINAL

Source: boring# C-2 **Sample No.:** C-2 **Elev./Depth:** 18-20 ft.

Remarks:
94% Passing #200 Sieve

CONSOLIDATION TEST REPORT

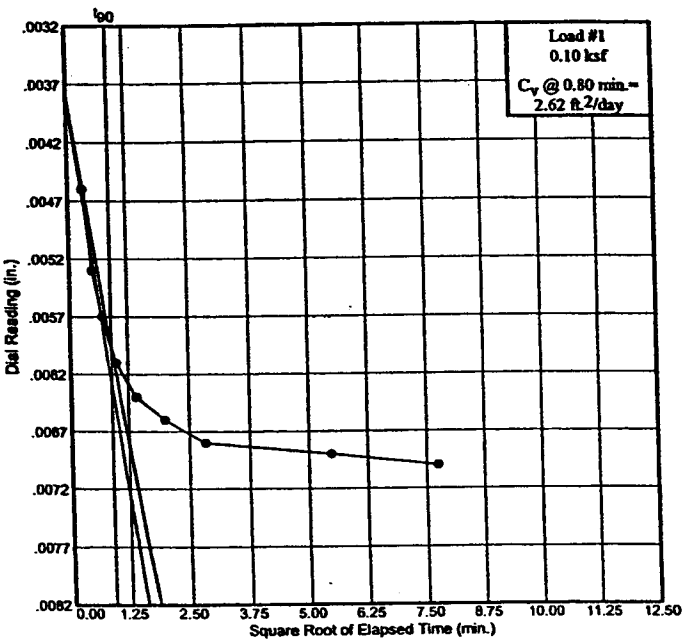
S & ME, Inc.

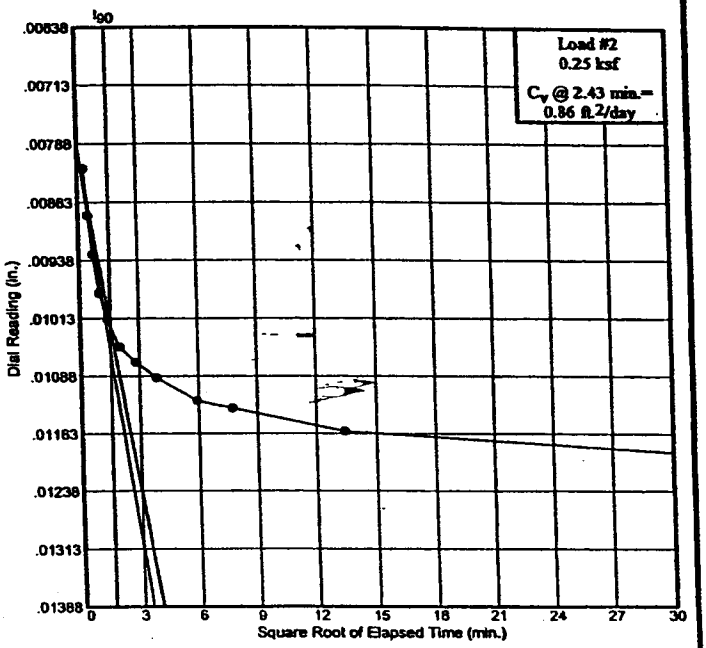
Plate

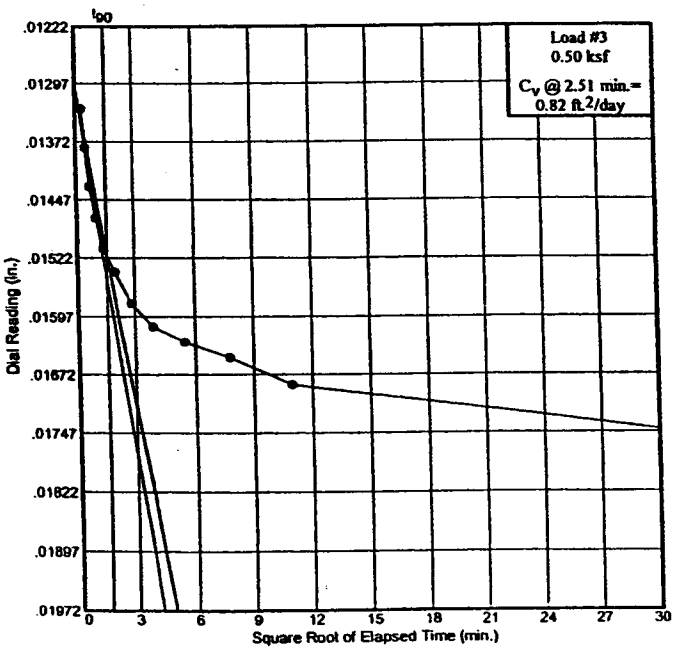
Dial Reading vs. Time

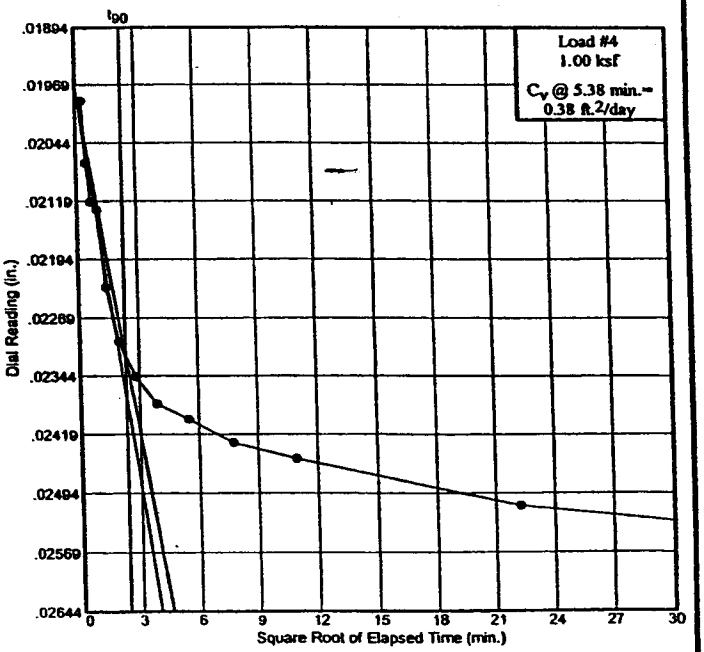
Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-2 Sample No.: C-2 Elev./Depth: 18-20 ft.









Dial Reading vs. Time

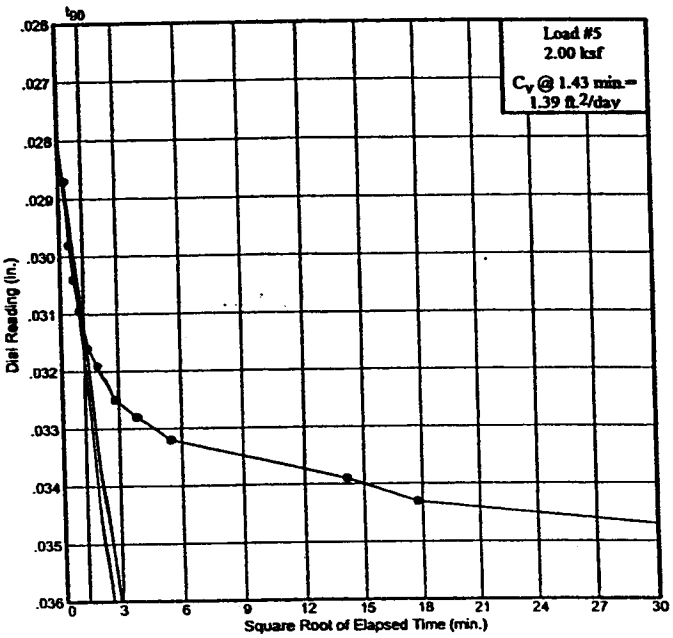
S & ME, Inc.

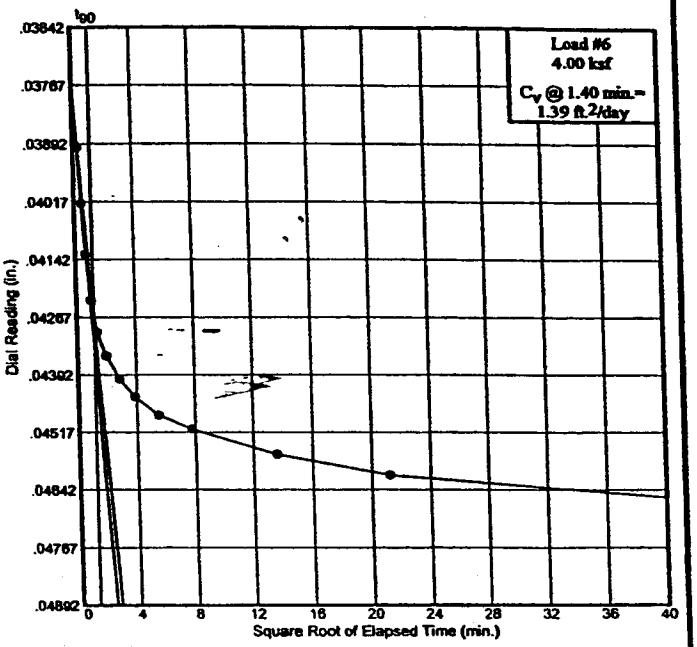
Plate

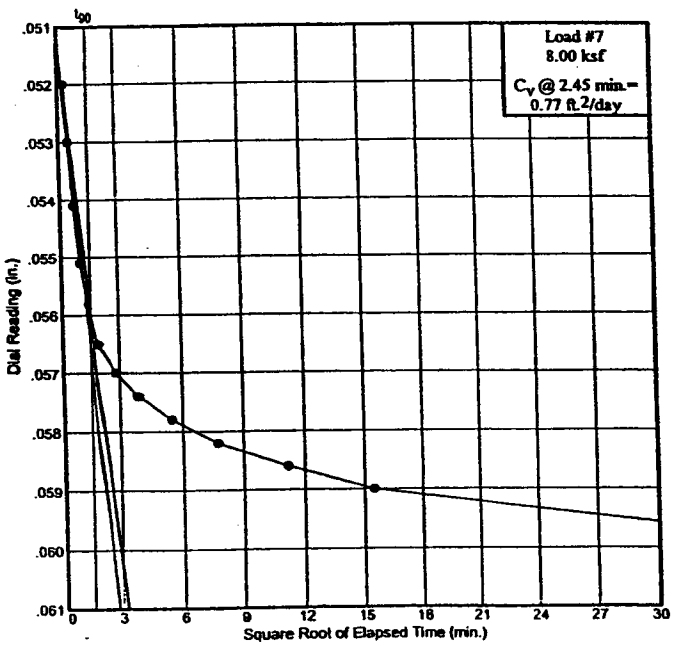
Dial Reading vs. Time

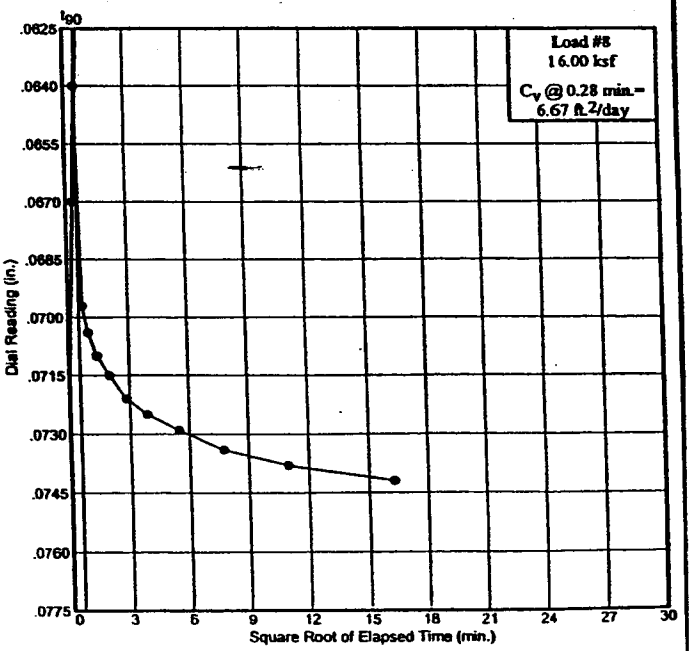
Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-2 Sample No.: C-2 Elev./Depth: 18-20 ft.









Dial Reading vs. Time

S & ME, Inc.

Plate

CONSOLIDATION TEST DATA

.ient: SHINER MOSELEY and ASSOCIATES
:oject: SHOAL POINT TERMINAL
:oject Number: 1131-99-588

Sample Data

ɔurce: boring# C-2
ample No.: C-2
lev. or Depth: 18-20 ft. Sample Length (in./cm.):
ɔcation:
escription:
iquid Limit: 42.3 Plasticity Index: 21.5
SCS: AASHTO: Figure No.:
esting Remarks: 94% Passing #200 Sieve

Test Specimen Data

TOTAL SAMPLE		BEFORE TEST	AFTER TEST
et w+t	= 83.60 g.	Consolidometer # = 1	Wet w+t = 263.07 g.
ry w+t	= 58.80 g.		Dry w+t = 234.39 g.
are Wt.	= .00 g.	Spec. Gravity = 2.67	Tare Wt. = 111.13 g.
eight	= 1.00 in.	Height = 1.00 in.	
iameter	= 2.50 in.	Diameter = 2.50 in.	
eight	= 120.00 g.	Defl. Table = Reference Set (inches/psf)	
oisture	= 42.2 %	Ht. Solids = 0.3930 in.	Moisture = 23.3 %
et Den.	= 93.1 pcf	Dry Wt. = 84.40 g.*	Dry Wt. = 123.26 g.
ry Den.	= 65.5 pcf	Void Ratio = 1.545	Void Ratio = 1.414
		Saturation = 72.9 %	

* Initial dry weight used in calculations

End-of-Load Summary

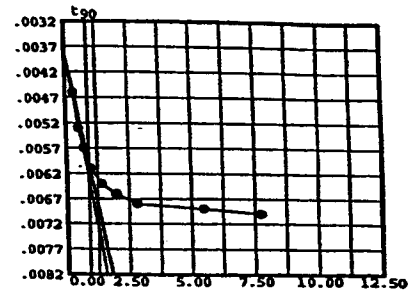
Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	0.00000				1.545	
0.10	0.00700	0.00000	2.62		1.529*	0.6 Comprs.*
0.25	0.01200	0.00000	0.86		1.518*	1.1 Comprs.*
0.50	0.01770	0.00000	0.82		1.505*	1.5 Comprs.*
1.00	0.02550	0.00000	0.38		1.485*	2.4 Comprs.*
2.00	0.03490	0.00000	1.39		1.464*	3.2 Comprs.*
4.00	0.04700	0.00000	1.39		1.435*	4.3 Comprs.*
8.00	0.05970	0.00000	0.77		1.401*	5.7 Comprs.*
16.00	0.07520	0.00000	6.67		1.382*	6.4 Comprs.*
4.00	0.07080	0.00000			1.393	6.0 Comprs.
2.00	0.06950	0.00000			1.397	5.8 Comprs.
0.10	0.06260	0.00000			1.414	5.1 Comprs.

*CALCULATED USING D_{100} INSTEAD OF FINAL READING

C_c = 0.10 P_c = 8.34 ksf C_r = 0.01

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

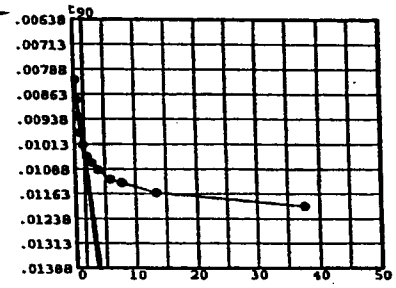
No.	Elapsed Time	Dial Reading
1	0.00	0.00000
2	0.10	0.00460
3	0.25	0.00530
4	0.50	0.00570
5	1.00	0.00610
6	2.00	0.00640
7	4.00	0.00660
8	8.00	0.00680
9	30.00	0.00690
10	60.00	0.00700



Void Ratio = 1.529 Compression = 0.6 % >>> CALCULATED USING D_{100}
D_0 = 0.00378 D_{90} = 0.00596 D_{100} = 0.00620
C_v at 0.8 min. = 2.62 ft.^{2}/day

Pressure: 0.25 ksf — **TEST READINGS** — **Load No. 2**

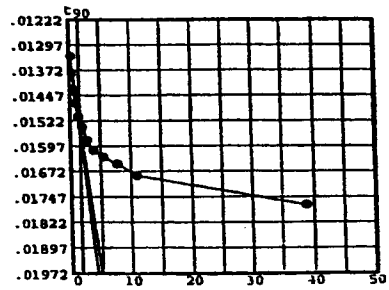
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00700	11	60.00	0.01130
2	0.10	0.00820	12	180.00	0.01160
3	0.25	0.00880	13	1415.00	0.01200
4	0.50	0.00930			
5	1.00	0.00980			
6	2.00	0.01015			
7	4.00	0.01050			
8	8.00	0.01070			
9	15.00	0.01090			
10	35.00	0.01120			



Void Ratio = 1.518 Compression = 1.1 % >>> CALCULATED USING D_{100}
D_0 = 0.00788 D_{90} = 0.01024 D_{100} = 0.01050
C_v at 2.4 min. = 0.86 ft.^{2}/day

Pressure: 0.50 ksf — **TEST READINGS** — **Load No. 3**

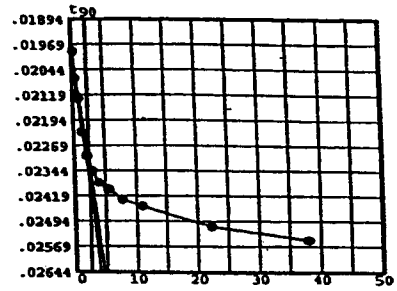
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01200	11	60.00	0.01650
2	0.10	0.01330	12	120.00	0.01685
3	0.25	0.01380	13	1500.00	0.01770
4	0.50	0.01430			
5	1.00	0.01470			
6	2.00	0.01510			
7	4.00	0.01540			
8	8.00	0.01580			
9	15.00	0.01610			
10	30.00	0.01630			



Void Ratio = 1.505 Compression = 1.5 % >>> CALCULATED USING D_{100}
D_0 = 0.01298 D_{90} = 0.01519 D_{100} = 0.01543
C_v at 2.5 min. = 0.82 ft.^{2}/day

essure: 1.00 ksf — TEST READINGS — Load No. 4

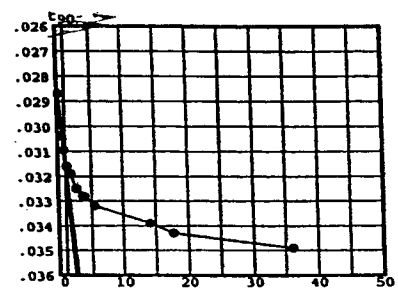
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01770	11	60.00	0.02430
2	0.10	0.01990	12	120.00	0.02450
3	0.25	0.02070	13	495.00	0.02510
4	0.50	0.02120	14	1445.00	0.02550
5	1.00	0.02130			
6	2.00	0.02230			
7	4.00	0.02300			
8	8.00	0.02345			
9	15.00	0.02380			
10	30.00	0.02400			



Void Ratio = 1.485 Compression = 2.4 % >>> CALCULATED USING D_{100}
D_0 = 0.01969 D_{90} = 0.02317 D_{100} = 0.02356
C_v at 5.4 min. = 0.38 ft.^{2}/day

essure: 2.00 ksf — TEST READINGS — Load No. 5

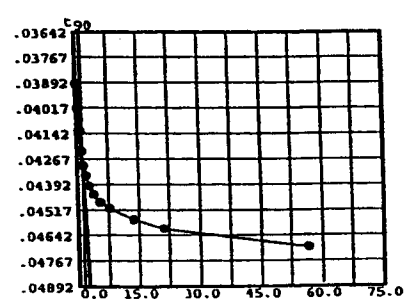
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.02550	11	200.00	0.03390
2	0.10	0.02870	12	315.00	0.03430
3	0.25	0.02980	13	1310.00	0.03490
4	0.50	0.03040			
5	1.00	0.03095			
6	2.00	0.03160			
7	4.00	0.03190			
8	8.00	0.03250			
9	15.00	0.03280			
10	30.00	0.03320			



Void Ratio = 1.464 Compression = 3.2 % >>> CALCULATED USING D_{100}
D_0 = 0.02797 D_{90} = 0.03126 D_{100} = 0.03163
C_v at 1.4 min. = 1.39 ft.^{2}/day

ressure: 4.00 ksf — TEST READINGS — Load No. 6

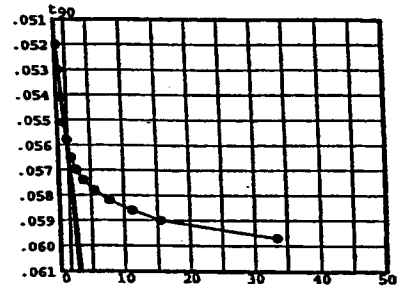
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.03490	11	60.00	0.04510
2	0.10	0.03900	12	185.00	0.04565
3	0.25	0.04020	13	450.00	0.04610
4	0.50	0.04130	14	3195.00	0.04700
5	1.00	0.04230			
6	2.00	0.04300			
7	4.00	0.04350			
8	8.00	0.04400			
9	15.00	0.04440			
10	30.00	0.04480			



Void Ratio = 1.435 Compression = 4.3 % >>> CALCULATED USING D_{100}
D_0 = 0.03768 D_{90} = 0.04261 D_{100} = 0.04316
C_v at 1.4 min. = 1.39 ft.^{2}/day

Pressure: 8.00 ksf — **TEST READINGS** — **Load No. 7**

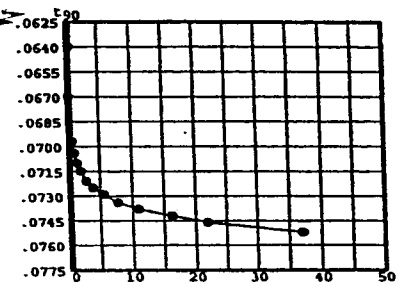
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.04700	11	60.00	0.05820
2	0.10	0.05200	12	125.00	0.05860
3	0.25	0.05300	13	240.00	0.05900
4	0.50	0.05410	14	1125.00	0.05970
5	1.00	0.05510			
6	2.00	0.05580			
7	4.00	0.05650			
8	8.00	0.05700			
9	15.00	0.05740			
10	30.00	0.05780			



Void Ratio = 1.401 Compression = 5.7 % >>> CALCULATED USING D_{100}
D_0 = 0.05128 D_{90} = 0.05598 D_{100} = 0.05650
C_v at 2.5 min. = 0.77 ft.^{2}/day

Pressure: 16.00 ksf — **TEST READINGS** — **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.05970	11	60.00	0.07340
2	0.10	0.06700	12	120.00	0.07380
3	0.25	0.06400	13	265.00	0.07420
4	0.50	0.06970	14	480.00	0.07460
5	1.00	0.07040	15	1375.00	0.07520
6	2.00	0.07100			
7	4.00	0.07150			
8	8.00	0.07210			
9	15.00	0.07250			
10	30.00	0.07290			



Void Ratio = 1.382 Compression = 6.4 % >>> CALCULATED USING D_{100}
D_0 = 0.07216 D_{90} = 0.06470 D_{100} = 0.06387
C_v at 0.3 min. = 6.67 ft.^{2}/day

Pressure: 4.00 ksf — **TEST READINGS** — **Load No. 9**

No.	Elapsed Time	Dial Reading
1	0.00	0.07520
2	0.10	0.07300
3	0.25	0.07270
4	0.50	0.07180
5	1.00	0.07130
6	2.00	0.07080
7	15.00	0.07080

Void Ratio = 1.393 Compression = 6.0 %

essure: 2.00 ksf — TEST READINGS — Load No. 10

No.	Elapsed Time	Dial Reading
1	0.00	0.07080
2	0.10	0.07000
3	0.25	0.06980
4	1280.00	0.06950

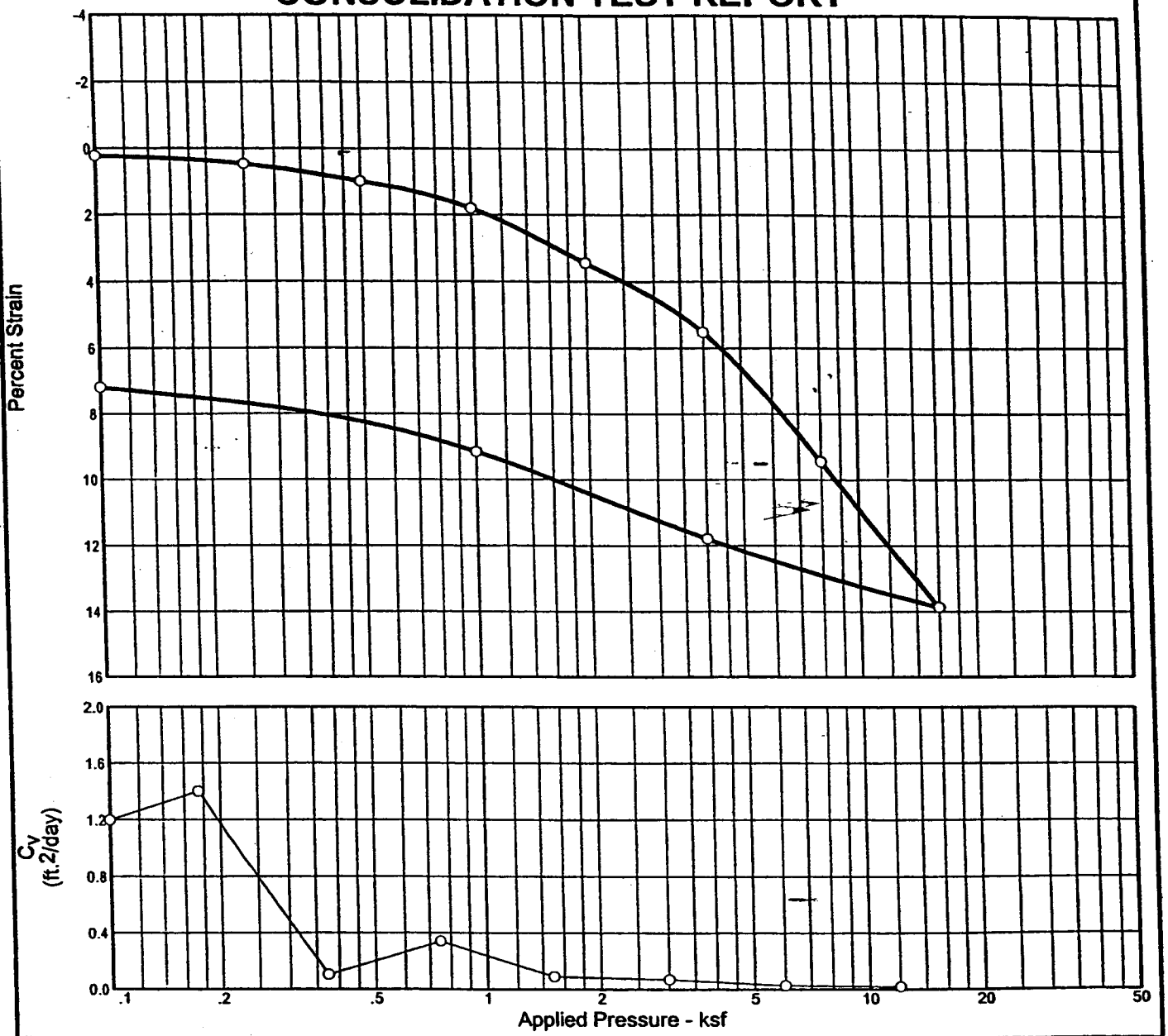
Void Ratio = 1.397 Compression = 5.8 %

essure: 0.10 ksf — TEST READINGS — Load No. 11

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.06950	11	210.00	0.06280
2	0.10	0.06620	12	450.00	0.06260
3	0.25	0.06570			
4	0.50	0.06530			
5	1.00	0.06480			
6	2.00	0.06420			
7	4.00	0.06380			
8	8.00	0.06350			
9	15.00	0.06310			
10	60.00	0.06300			

Void Ratio = 1.414 Compression = 5.1 %

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Swell %	e_o
100.0 %	31.1 %	92.3	66	42.5	2.67		4.47	0.26	0.06			0.805

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 1131-99-588 **Client:**

Project:

Source: C-3 **Sample No.:** C-3 **Elev./Depth:** 8-10 ft.

Remarks:
90.8 % Passing # 200 sieve

CONSOLIDATION TEST REPORT

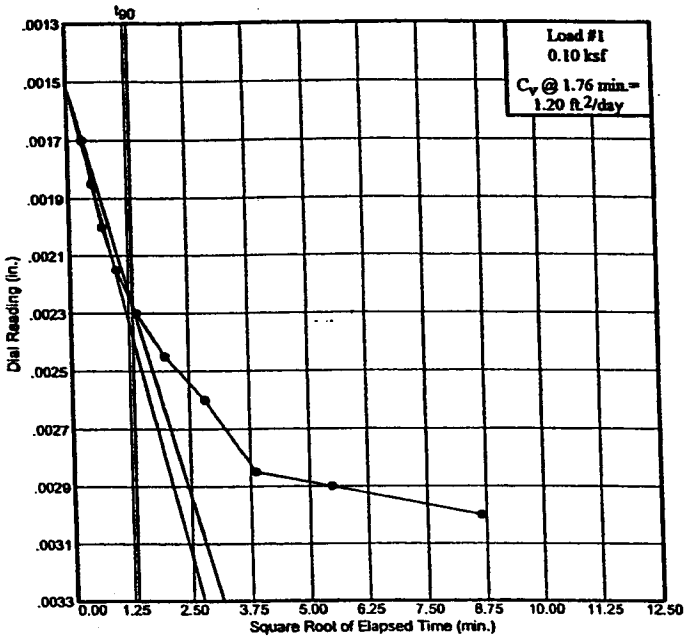
S & ME, Inc.

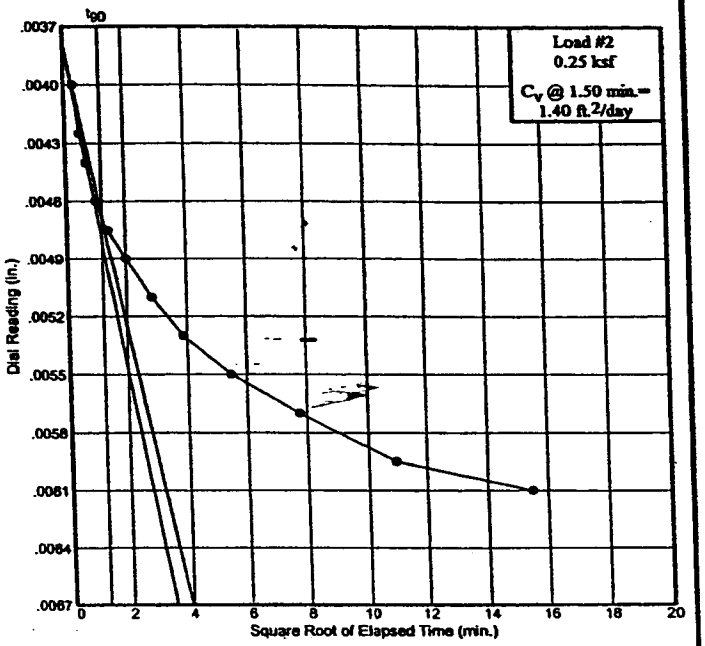
Plate

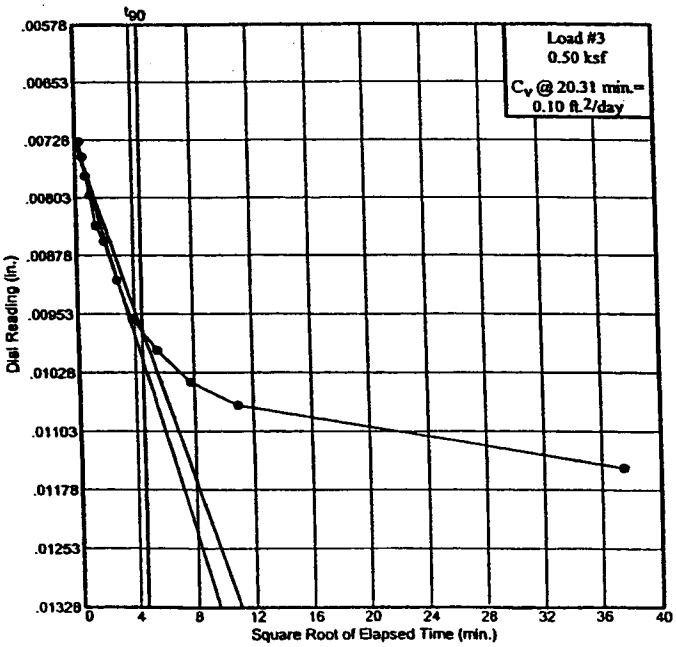
Dial Reading vs. Time

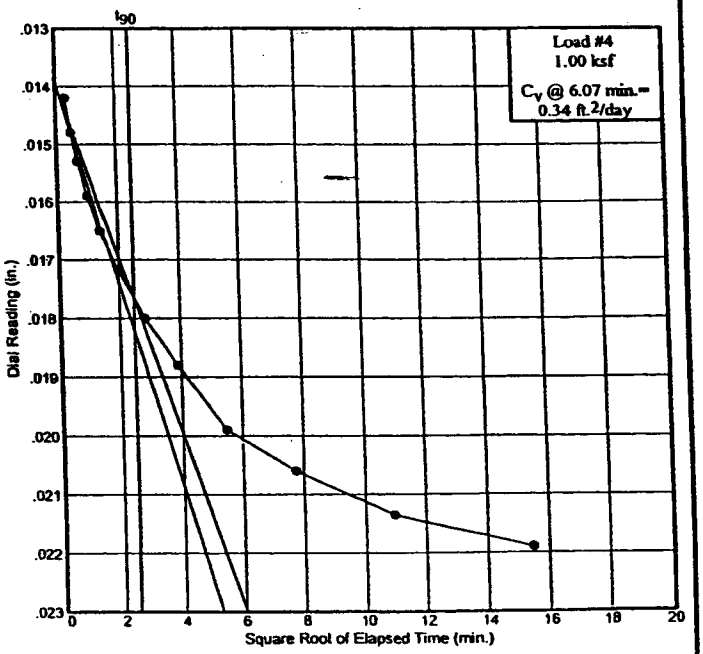
Project No.: 1131-99-588
Project:

Source: C-3 Sample No.: C-3 Elev./Depth: 8-10 ft.









Dial Reading vs. Time

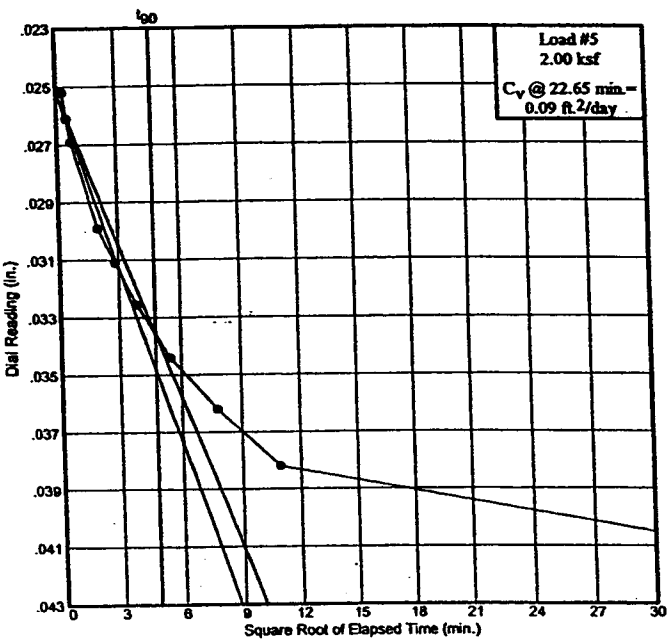
S & ME, Inc.

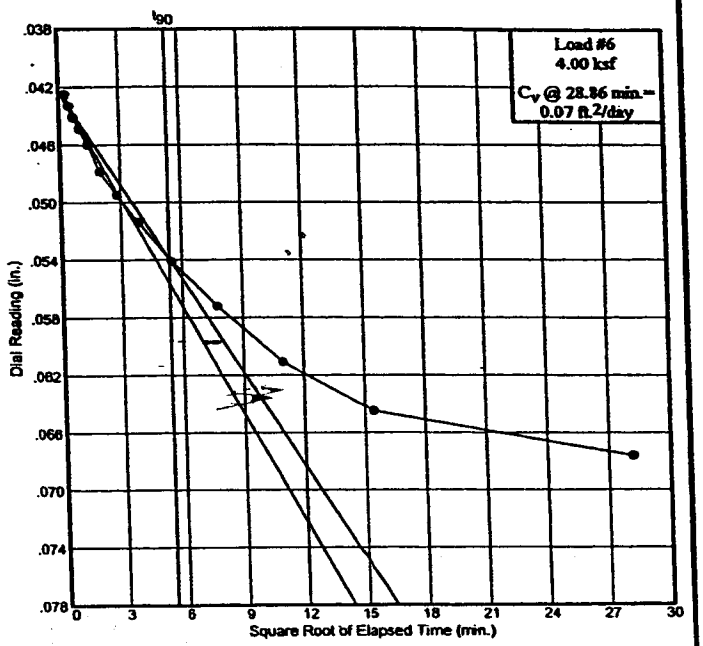
Plate

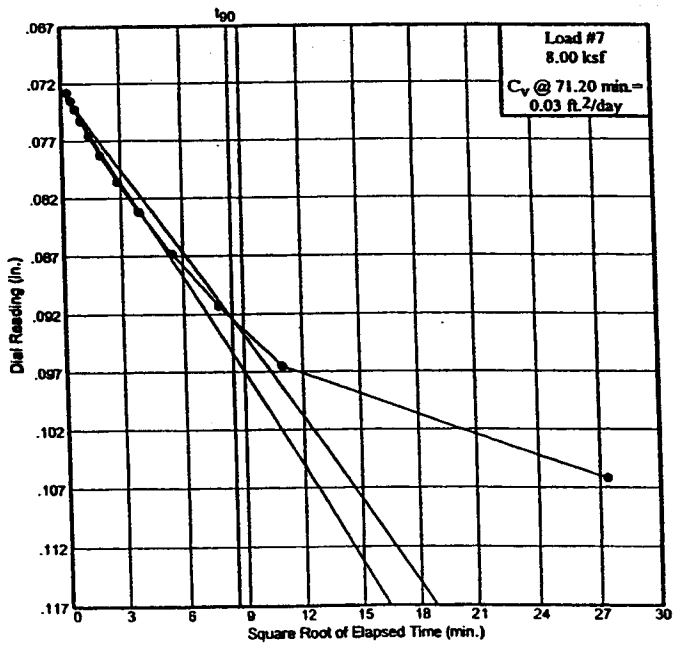
Dial Reading vs. Time

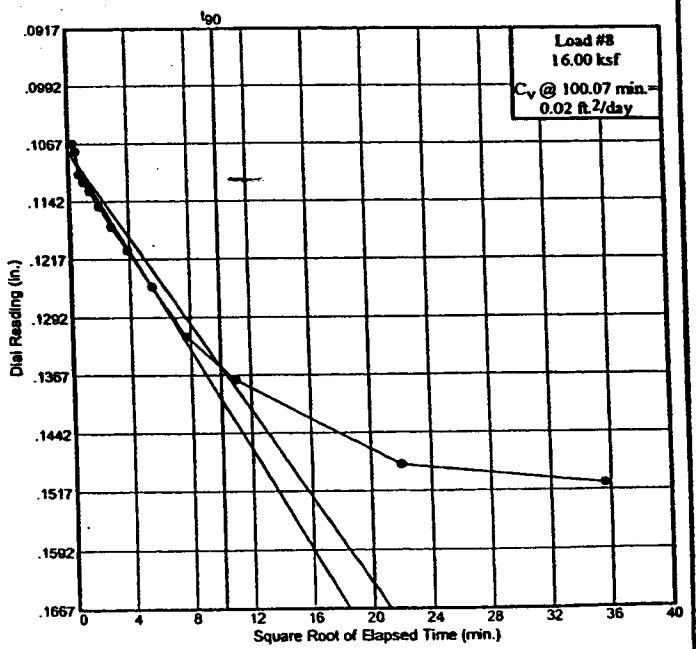
Project No.: 1131-99-588
Project:

Source: C-3 Sample No.: C-3 Elev./Depth: 8-10 ft.









Dial Reading vs. Time

S & ME, Inc.

Plate

CONSOLIDATION TEST DATA

ient:
oject:
oject Number: 1131-99-588

Sample Data

urce: C-3
mple No.: C-3
ev. or Depth: 8-10 ft. Sample Length (in./cm.):
cation:
scription:
quid Limit: 66 Plasticity Index: 42.5
CS: AASHTO: Figure No.:
sting Remarks: 90.8 % Passing # 200 sieve

Test Specimen Data

TOTAL SAMPLE		BEFORE TEST	AFTER TEST	
t w+t	= 70.00 g.	Consolidometer # = 3	Wet w+t	= 263.55 g.
y w+t	= 53.40 g.		Dry w+t	= 226.29 g.
re Wt.	= .00 g.	Spec. Gravity = 2.67	Tare Wt.	= 111.16 g.
eight	= 1.00 in.	Height = 1.00 in.		
ameter	= 2.50 in.	Diameter = 2.50 in.		
eight	= 155.97 g.	Defl. Table = Reference Set (inches/ksf)		
oisture	= 31.1 %	Ht. Solids = 0.5540 in.	Moisture	= 32.4 %
et Den.	= 121.0 pcf	Dry Wt. = 118.98 g.*	Dry Wt.	= 115.13 g.
ry Den.	= 92.3 pcf	Void Ratio = 0.805	Void Ratio	= 0.675
		Saturation = 100.0 %		

Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	0.00000				0.805	
0.10	0.00300	0.00000	1.20		0.801*	0.2 Comprs.*
0.25	0.00610	0.00000	1.40		0.796*	0.5 Comprs.*
0.50	0.01190	0.00040	0.10		0.787*	1.0 Comprs.*
1.00	0.02270	0.00080	0.34		0.772*	1.8 Comprs.*
2.00	0.04230	0.00160	0.09		0.743*	3.5 Comprs.*
4.00	0.07000	0.00240	0.07		0.705*	5.5 Comprs.*
8.00	0.10620	0.00000	0.03		0.634*	9.5 Comprs.*
16.00	0.15080	0.00000	0.02		0.555*	13.9 Comprs.*
4.00	0.13300	0.00300			0.592	11.8 Comprs.
1.00	0.10450	0.00080			0.640	9.2 Comprs.
0.10	0.08400	0.00000			0.675	7.2 Comprs.

CALCULATED USING D_{100} INSTEAD OF FINAL READING

C_c = 0.26 P_c = 4.47 ksf C_r = 0.06

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00000	11	75.00	0.00300
2	0.10	0.00170			
3	0.25	0.00185			
4	0.50	0.00200			
5	1.00	0.00215			
6	2.00	0.00230			
7	4.00	0.00245			
8	8.00	0.00260			
9	15.00	0.00285			
10	30.00	0.00290			

Void Ratio = 0.801 **Compression** = 0.2 % >>> CALCULATED USING D_{100}
D_0 = 0.00151 D_{90} = 0.00227 D_{100} = 0.00235
C_v at 1.8 min. = 1.20 ft.^{2}/day

Pressure: 0.25 ksf — **TEST READINGS** — **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00300	11	60.00	0.00570
2	0.10	0.00400	12	120.00	0.00595
3	0.25	0.00425	13	240.00	0.00610
4	0.50	0.00440			
5	1.00	0.00460			
6	2.00	0.00475			
7	4.00	0.00490			
8	8.00	0.00510			
9	15.00	0.00530			
10	30.00	0.00550			

Void Ratio = 0.796 **Compression** = 0.5 % >>> CALCULATED USING D_{100}
D_0 = 0.00378 D_{90} = 0.00468 D_{100} = 0.00478
C_v at 1.5 min. = 1.40 ft.^{2}/day

Pressure: 0.50 ksf — **TEST READINGS** — **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00610	11	60.00	0.01080
2	0.10	0.00770	12	120.00	0.01110
3	0.25	0.00790	13	1405.00	0.01190
4	0.50	0.00815			
5	1.00	0.00840			
6	2.00	0.00880			
7	4.00	0.00900			
8	8.00	0.00950			
9	15.00	0.01000			
10	30.00	0.01040			

Void Ratio = 0.787 **Compression** = 1.0 % >>> CALCULATED USING D_{100}
D_0 = 0.00728 D_{90} = 0.00976 D_{100} = 0.01003
C_v at 20.3 min. = 0.10 ft.^{2}/day

Pressure: 1.00 ksf — TEST READINGS — Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01190	11	60.00	0.02140
2	0.10	0.01500	12	120.00	0.02215
3	0.25	0.01560	13	240.00	0.02270
4	0.50	0.01610			
5	1.00	0.01670			
6	2.00	0.01730			
7	4.00	0.01800			
8	8.00	0.01880			
9	15.00	0.01960			
10	30.00	0.02070			

Void Ratio = 0.772 Compression = 1.8 % >>> CALCULATED USING D_{100}
D_0 = 0.01394 D_{90} = 0.01765 D_{100} = 0.01806
C_v at 6.1 min. = 0.34 ft.^{2}/day

Pressure: 2.00 ksf — TEST READINGS — Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.02270	11	1000.00	0.04230
2	0.10	0.02680			
3	0.25	0.02770			
4	0.50	0.02850			
5	4.00	0.03150			
6	8.00	0.03270			
7	15.00	0.03415			
8	30.00	0.03600			
9	60.00	0.03780			
10	120.00	0.03980			

Void Ratio = 0.743 Compression = 3.5 % >>> CALCULATED USING D_{100}
D_0 = 0.02516 D_{90} = 0.03357 D_{100} = 0.03451
C_v at 22.7 min. = 0.09 ft.^{2}/day

Pressure: 4.00 ksf — TEST READINGS — Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.04230	11	60.00	0.05960
2	0.10	0.04490	12	120.00	0.06350
3	0.25	0.04570	13	240.00	0.06690
4	0.50	0.04650	14	795.00	0.07000
5	1.00	0.04730			
6	2.00	0.04840			
7	4.00	0.05030			
8	8.00	0.05190			
9	15.00	0.05380			
10	30.00	0.05650			

Void Ratio = 0.705 Compression = 5.5 % >>> CALCULATED USING D_{100}
D_0 = 0.04225 D_{90} = 0.05392 D_{100} = 0.05522
C_v at 28.9 min. = 0.07 ft.^{2}/day

Pressure: 8.00 ksf — **TEST READINGS** — **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.07000	11	60.00	0.09130
2	0.10	0.07280	12	120.00	0.09650
3	0.25	0.07350	13	750.00	0.10620
4	0.50	0.07425			
5	1.00	0.07530			
6	2.00	0.07660			
7	4.00	0.07830			
8	8.00	0.08060			
9	15.00	0.08320			
10	30.00	0.08680			

Void Ratio = 0.634 Compression = 9.5 % >>> CALCULATED USING D_{100}
D_0 = 0.07245 D_{90} = 0.09242 D_{100} = 0.09464
C_v at 71.2 min. = 0.03 ft.^{2}/day

Pressure: 16.00 ksf — **TEST READINGS** — **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.10620	11	60.00	0.13170
2	0.10	0.10670	12	120.00	0.13730
3	0.25	0.10770	13	485.00	0.14830
4	0.50	0.11070	14	1270.00	0.15080
5	1.00	0.11170			
6	2.00	0.11290			
7	4.00	0.11490			
8	8.00	0.11750			
9	15.00	0.12060			
10	30.00	0.12530			

Void Ratio = 0.555 Compression = 13.9 % >>> CALCULATED USING D_{100}
D_0 = 0.10765 D_{90} = 0.13564 D_{100} = 0.13875
C_v at 100.1 min. = 0.02 ft.^{2}/day

Pressure: 4.00 ksf — **TEST READINGS** — **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.15080	11	60.00	0.13800
2	0.10	0.14860	12	120.00	0.14600
3	0.25	0.14840	13	300.00	0.13300
4	0.50	0.14790			
5	1.00	0.14750			
6	2.00	0.14680			
7	4.00	0.14590			
8	8.00	0.14450			
9	15.00	0.14290			
10	30.00	0.14070			

Void Ratio = 0.592 Compression = 11.8 %

Pressure: 1.00 ksf — **TEST READINGS** — **Load No. 10**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.13300	11	1155.00	0.10450
2	0.10	0.13190			
3	0.25	0.13170			
4	0.50	0.13140			
5	1.00	0.13090			
6	4.00	0.12950			
7	8.00	0.12800			
8	15.00	0.12570			
9	60.00	0.12100			
10	120.00	0.11700			

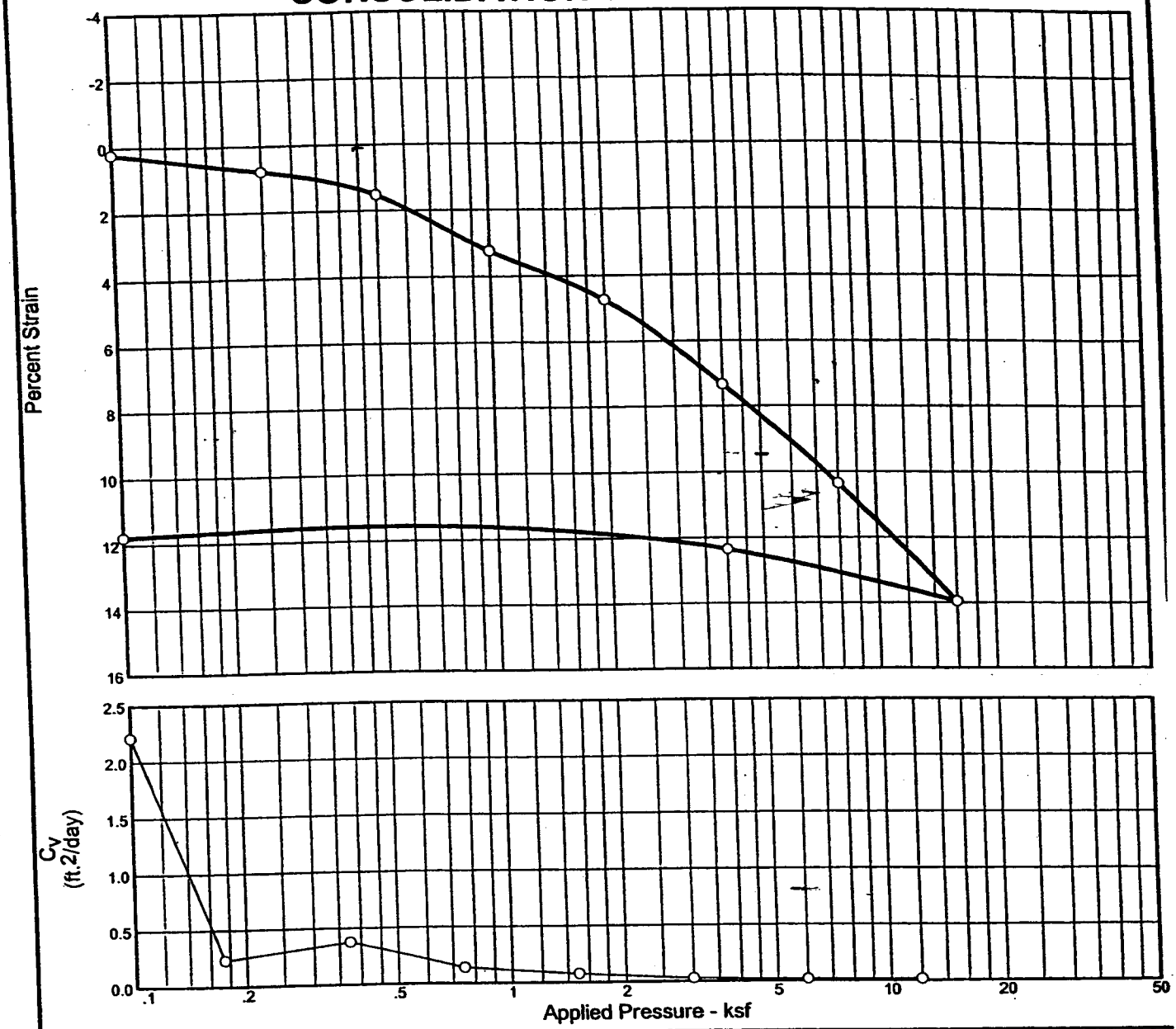
Void Ratio = 0.640 **Compression** = 9.2 %

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 11**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.10450	11	480.00	0.09400
2	0.10	0.10400			
3	0.25	0.10380			
4	0.50	0.10360			
5	1.00	0.10340			
6	2.00	0.10310			
7	4.00	0.10260			
8	8.00	0.10190			
9	15.00	0.10090			
10	30.00	0.09940			

Void Ratio = 0.675 **Compression** = 7.2 %

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Swell %	e_o
Sat.	Moist.											
100.0 %	30.5 %	97.6	57	41.2	2.66		1.93	0.21	0.03			0.702

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 1131-99-588 **Client:** SHINER MOSELEY and ASSOCIATES

Project: SHOAL POINT TERMINAL

Source: boring# C-3 **Sample No.:** C-3 **Elev./Depth:** 13-15 ft.

Remarks:
98.1% Passing #200 Sieve

CONSOLIDATION TEST REPORT

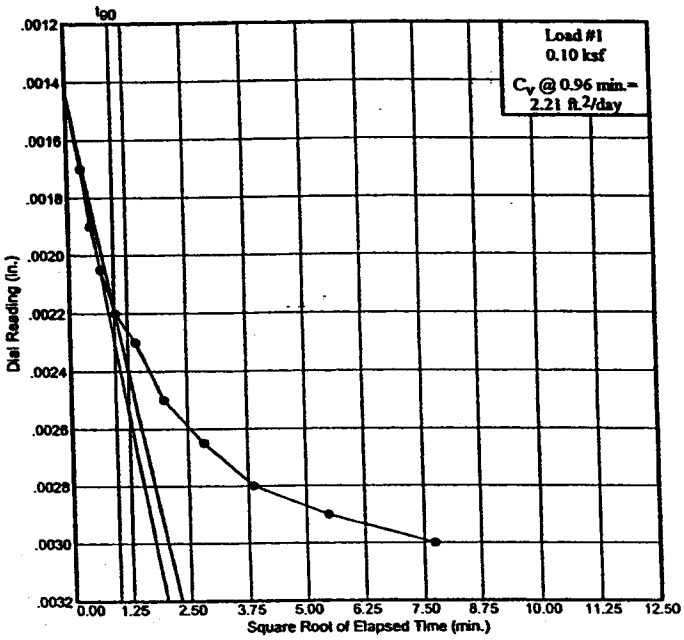
S & ME, Inc.

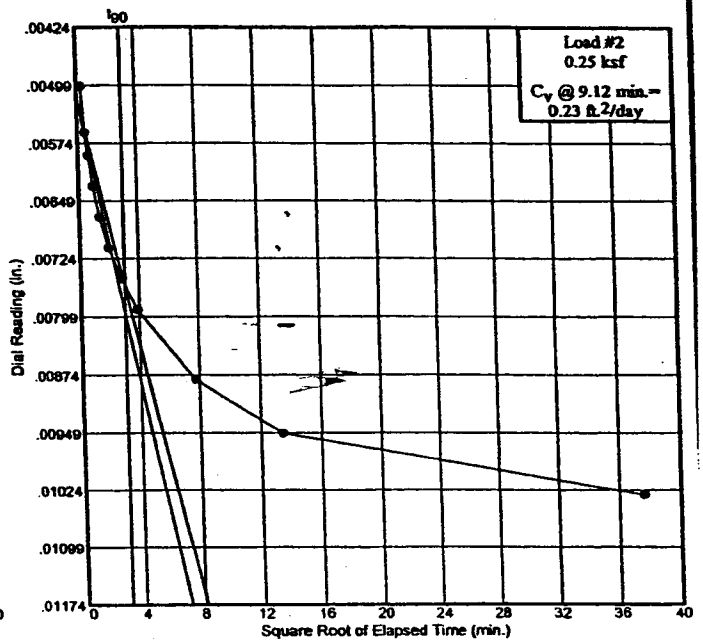
Plate

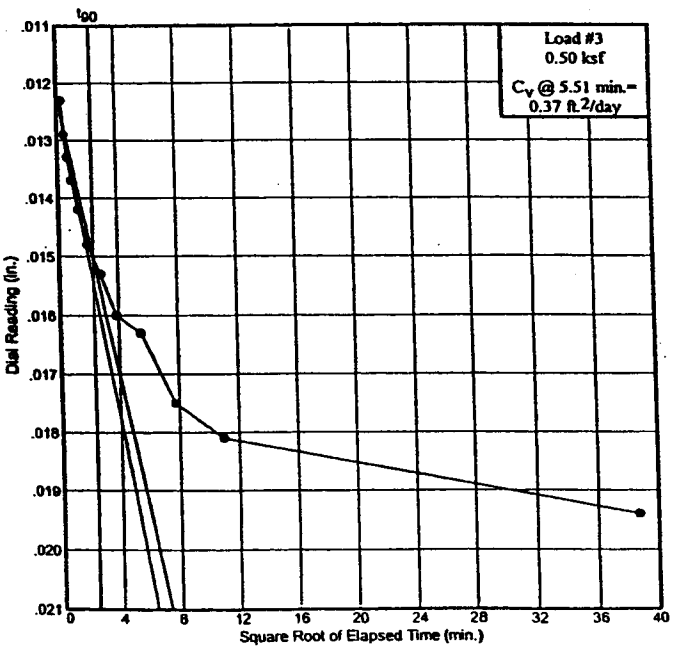
Dial Reading vs. Time

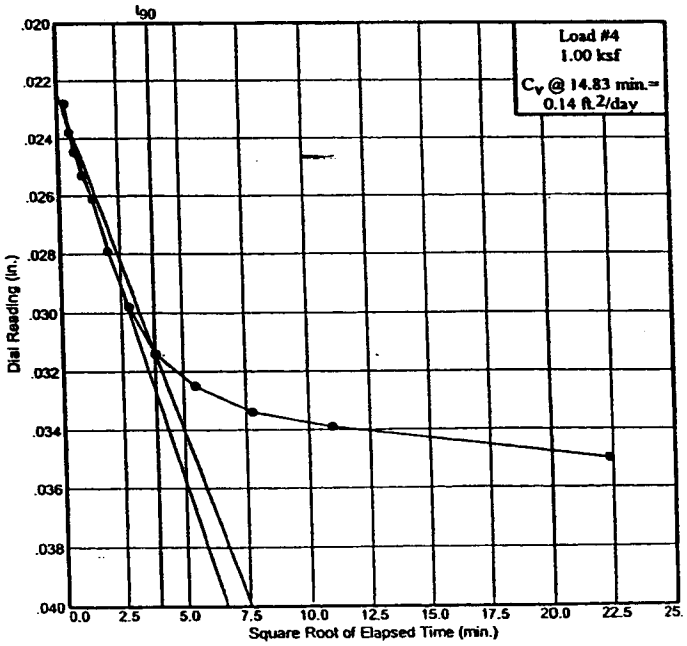
Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-3 Sample No.: C-3 Elev./Depth: 13-15 ft.









Dial Reading vs. Time

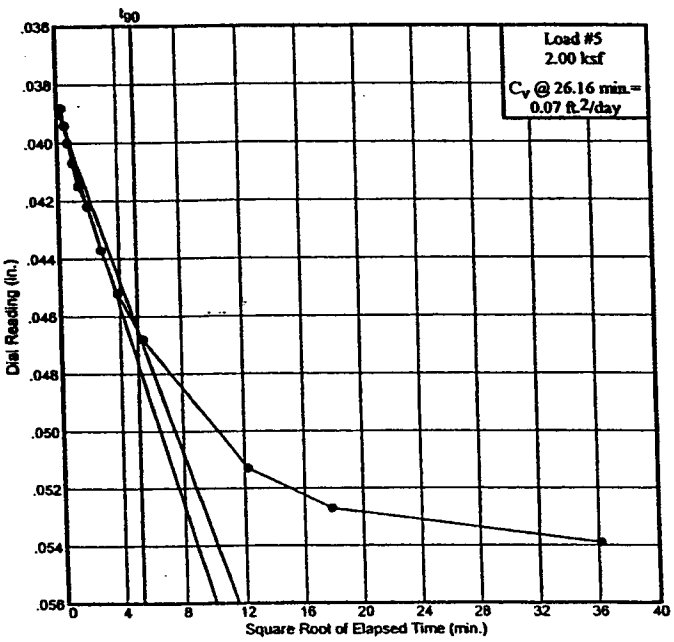
S & ME, Inc.

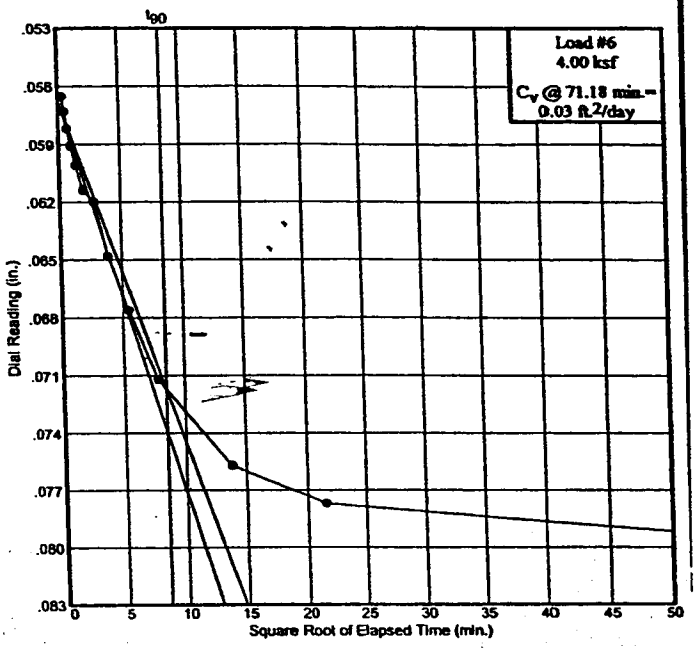
Plate

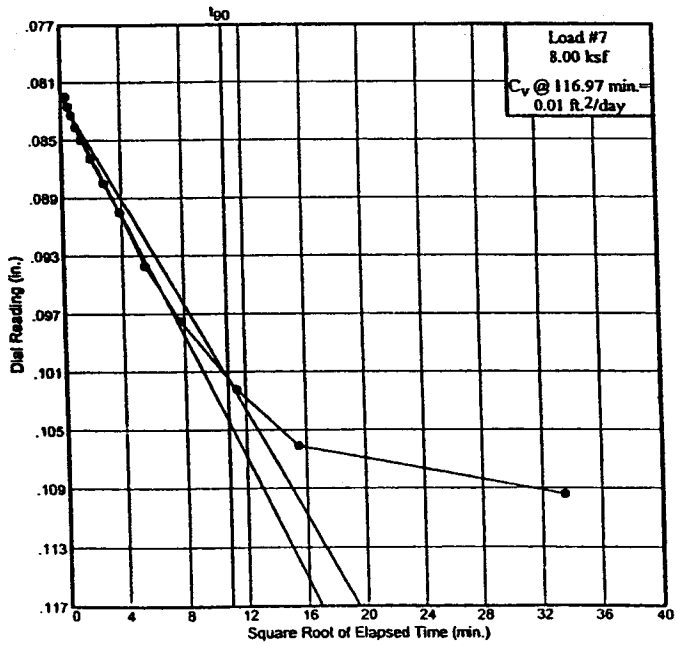
Dial Reading vs. Time

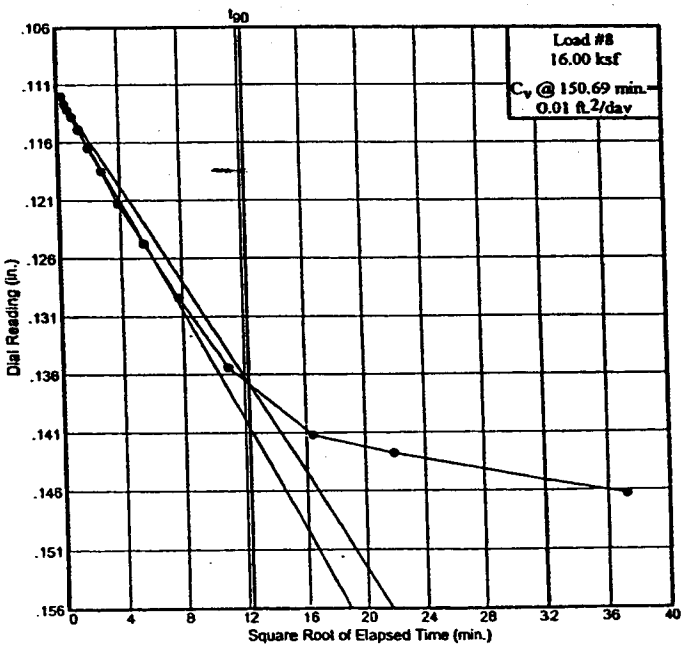
Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-3 Sample No.: C-3 Elev./Depth: 13-15 ft.









Dial Reading vs. Time

S & ME, Inc.

Plate

CONSOLIDATION TEST DATA

lient: SHINER MOSELEY and ASSOCIATES
roject: SHOAL POINT TERMINAL
roject Number: 1131-99-588

Sample Data

ource: boring# C-3
ample No.: C-3
lev. or Depth: 13-15 ft. Sample Length (in./cm.):
ocation:
escription:
iquid Limit: 57 Plasticity Index: 41.2
JSCS: AASHTO: Figure No.:
esting Remarks: 98.1% Passing #200 Sieve

Test Specimen Data

TOTAL SAMPLE		BEFORE TEST	AFTER TEST
Wet w+t =	35.10 g.	Consolidometer # = 3	Wet w+t = 269.73 g.
Dry w+t =	26.90 g.		Dry w+t = 234.28 g.
Tare Wt. =	.00 g.	Spec. Gravity = 2.66	Tare Wt. = 108.48 g.
Height =	1.00 in.	Height = 1.00 in.	
Diameter =	2.50 in.	Diameter = 2.50 in.	
Weight =	164.03 g.	Defl. Table = Reference Set (inches/psf)	
Moisture =	30.5 %	Ht. Solids = 0.5875 in.	Moisture = 28.2 %
Wet Den. =	127.3 pcf	Dry Wt. = 125.71 g.*	Dry Wt. = 125.80 g.
Dry Den. =	97.6 pcf	Void Ratio = 0.702	Void Ratio = 0.502
		Saturation = 100.0 %	

* Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	0.00000				0.702	
0.10	0.00300	0.00000	2.21		0.698*	0.2 Comprs.*
0.25	0.01030	0.00000	0.23		0.689*	0.8 Comprs.*
0.50	0.01940	0.00000	0.37		0.676*	1.5 Comprs.*
1.00	0.03500	0.00000	0.14		0.647*	3.2 Comprs.*
2.00	0.05390	0.00000	0.07		0.622*	4.7 Comprs.*
4.00	0.07950	0.00000	0.03		0.577*	7.3 Comprs.*
8.00	0.10940	0.00000	0.01		0.526*	10.4 Comprs.*
16.00	0.14630	0.00000	0.01		0.464*	14.0 Comprs.*
4.00	0.13020	0.00000			0.492	12.4 Comprs.
0.10	0.12450	0.00000			0.502	11.8 Comprs.

*CALCULATED USING D_{100} INSTEAD OF FINAL READING

C_c = 0.21 P_c = 1.93 ksf C_r = 0.03

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00000	11	60.00	0.00300
2	0.10	0.00170			
3	0.25	0.00190			
4	0.50	0.00205			
5	1.00	0.00220			
6	2.00	0.00230			
7	4.00	0.00250			
8	8.00	0.00265			
9	15.00	0.00280			
10	30.00	0.00290			

Void Ratio = 0.698 Compression = 0.2 % >>> CALCULATED USING D_{100}
D_0 = 0.00143 D_{90} = 0.00219 D_{100} = 0.00227
C_v at 1.0 min. = 2.21 ft.^{2}/day

Pressure: 0.25 ksf — **TEST READINGS** — **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00300	11	180.00	0.00950
2	0.10	0.00500	12	1415.00	0.01030
3	0.25	0.00560			
4	0.50	0.00590			
5	1.00	0.00630			
6	2.00	0.00670			
7	4.00	0.00710			
8	8.00	0.00750			
9	15.00	0.00790			
10	60.00	0.00880			

Void Ratio = 0.689 Compression = 0.8 % >>> CALCULATED USING D_{100}
D_0 = 0.00514 D_{90} = 0.00757 D_{100} = 0.00784
C_v at 9.1 min. = 0.23 ft.^{2}/day

Pressure: 0.50 ksf — **TEST READINGS** — **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01030	11	60.00	0.01750
2	0.10	0.01230	12	120.00	0.01810
3	0.25	0.01290	13	1500.00	0.01940
4	0.50	0.01330			
5	1.00	0.01370			
6	2.00	0.01420			
7	4.00	0.01480			
8	8.00	0.01530			
9	15.00	0.01600			
10	30.00	0.01630			

Void Ratio = 0.676 Compression = 1.5 % >>> CALCULATED USING D_{100}
D_0 = 0.01214 D_{90} = 0.01501 D_{100} = 0.01533
C_v at 5.5 min. = 0.37 ft.^{2}/day

ressure: 1.00 ksf — TEST READINGS — Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01940	11	60.00	0.03340
2	0.10	0.02280	12	120.00	0.03390
3	0.25	0.02380	13	500.00	0.03500
4	0.50	0.02450			
5	1.00	0.02530			
6	2.00	0.02610			
7	4.00	0.02790			
8	8.00	0.02980			
9	15.00	0.03140			
10	30.00	0.03250			

Void Ratio = 0.647 Compression = 3.2 % >>> CALCULATED USING D_{100}
D_0 = 0.02238 D_{90} = 0.03137 D_{100} = 0.03236
C_v at 14.8 min. = 0.14 ft.^{2}/day

Pressure: 2.00 ksf — TEST READINGS — Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.03500	11	150.00	0.05130
2	0.10	0.03880	12	320.00	0.05270
3	0.25	0.03940	13	1310.00	0.05390
4	0.50	0.04000			
5	1.00	0.04070			
6	2.00	0.04150			
7	4.00	0.04220			
8	8.00	0.04370			
9	15.00	0.04520			
10	30.00	0.04680			

Void Ratio = 0.622 Compression = 4.7 % >>> CALCULATED USING D_{100}
D_0 = 0.03868 D_{90} = 0.04644 D_{100} = 0.04730
C_v at 26.2 min. = 0.07 ft.^{2}/day

Pressure: 4.00 ksf — TEST READINGS — Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.05390	11	60.00	0.07120
2	0.10	0.05650	12	190.00	0.07570
3	0.25	0.05730	13	465.00	0.07770
4	0.50	0.05820	14	3195.00	0.07950
5	1.00	0.05910			
6	2.00	0.06010			
7	4.00	0.06140			
8	8.00	0.06200			
9	15.00	0.06480			
10	30.00	0.06760			

Void Ratio = 0.577 Compression = 7.3 % >>> CALCULATED USING D_{100}
D_0 = 0.05664 D_{90} = 0.07172 D_{100} = 0.07339
C_v at 71.2 min. = 0.03 ft.^{2}/day

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00000	11	75.00	0.00300
2	0.10	0.00170			
3	0.25	0.00185			
4	0.50	0.00200			
5	1.00	0.00215			
6	2.00	0.00230			
7	4.00	0.00245			
8	8.00	0.00260			
9	15.00	0.00285			
10	30.00	0.00290			

Void Ratio = 0.801 **Compression** = 0.2 % >>> CALCULATED USING D_{100}
D_0 = 0.00151 D_{90} = 0.00227 D_{100} = 0.00235
C_v at 1.8 min. = 1.20 ft.^{2}/day

Pressure: 0.25 ksf — **TEST READINGS** — **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00300	11	60.00	0.00570
2	0.10	0.00400	12	120.00	0.00595
3	0.25	0.00425	13	240.00	0.00610
4	0.50	0.00440			
5	1.00	0.00460			
6	2.00	0.00475			
7	4.00	0.00490			
8	8.00	0.00510			
9	15.00	0.00530			
10	30.00	0.00550			

Void Ratio = 0.796 **Compression** = 0.5 % >>> CALCULATED USING D_{100}
D_0 = 0.00378 D_{90} = 0.00468 D_{100} = 0.00478
C_v at 1.5 min. = 1.40 ft.^{2}/day

Pressure: 0.50 ksf — **TEST READINGS** — **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00610	11	60.00	0.01080
2	0.10	0.00770	12	120.00	0.01110
3	0.25	0.00790	13	1405.00	0.01190
4	0.50	0.00815			
5	1.00	0.00840			
6	2.00	0.00880			
7	4.00	0.00900			
8	8.00	0.00950			
9	15.00	0.01000			
10	30.00	0.01040			

Void Ratio = 0.787 **Compression** = 1.0 % >>> CALCULATED USING D_{100}
D_0 = 0.00728 D_{90} = 0.00976 D_{100} = 0.01003
C_v at 20.3 min. = 0.10 ft.^{2}/day

ressure: 1.00 ksf — TEST READINGS — Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01190	11	60.00	0.02140
2	0.10	0.01500	12	120.00	0.02215
3	0.25	0.01560	13	240.00	0.02270
4	0.50	0.01610			
5	1.00	0.01670			
6	2.00	0.01730			
7	4.00	0.01800			
8	8.00	0.01880			
9	15.00	0.01960			
10	30.00	0.02070			

Void Ratio = 0.772 Compression = 1.8 % >>> CALCULATED USING D_{100}
D_0 = 0.01394 D_{90} = 0.01765 D_{100} = 0.01806
C_v at 6.1 min. = 0.34 ft.^{2}/day

ressure: 2.00 ksf — TEST READINGS — Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.02270	11	1000.00	0.04230
2	0.10	0.02680			
3	0.25	0.02770			
4	0.50	0.02850			
5	4.00	0.03150			
6	8.00	0.03270			
7	15.00	0.03415			
8	30.00	0.03600			
9	60.00	0.03780			
10	120.00	0.03980			

Void Ratio = 0.743 Compression = 3.5 % >>> CALCULATED USING D_{100}
D_0 = 0.02516 D_{90} = 0.03357 D_{100} = 0.03451
C_v at 22.7 min. = 0.09 ft.^{2}/day

Pressure: 4.00 ksf — TEST READINGS — Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.04230	11	60.00	0.05960
2	0.10	0.04490	12	120.00	0.06350
3	0.25	0.04570	13	240.00	0.06690
4	0.50	0.04650	14	795.00	0.07000
5	1.00	0.04730			
6	2.00	0.04840			
7	4.00	0.05030			
8	8.00	0.05190			
9	15.00	0.05380			
10	30.00	0.05650			

Void Ratio = 0.705 Compression = 5.5 % >>> CALCULATED USING D_{100}
D_0 = 0.04225 D_{90} = 0.05392 D_{100} = 0.05522
C_v at 28.9 min. = 0.07 ft.^{2}/day

Pressure: 8.00 ksf — **TEST READINGS** — **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.07000	11	60.00	0.09130
2	0.10	0.07280	12	120.00	0.09650
3	0.25	0.07350	13	750.00	0.10620
4	0.50	0.07425			
5	1.00	0.07530			
6	2.00	0.07660			
7	4.00	0.07830			
8	8.00	0.08060			
9	15.00	0.08320			
10	30.00	0.08680			

Void Ratio = 0.634 **Compression** = 9.5 % >>> CALCULATED USING D_{100}
D_0 = 0.07245 D_{90} = 0.09242 D_{100} = 0.09464
C_v at 71.2 min. = 0.03 ft.^{2}/day

Pressure: 16.00 ksf — **TEST READINGS** — **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.10620	11	60.00	0.13170
2	0.10	0.10670	12	120.00	0.13730
3	0.25	0.10770	13	485.00	0.14830
4	0.50	0.11070	14	1270.00	0.15080
5	1.00	0.11170			
6	2.00	0.11290			
7	4.00	0.11490			
8	8.00	0.11750			
9	15.00	0.12060			
10	30.00	0.12530			

Void Ratio = 0.555 **Compression** = 13.9 % >>> CALCULATED USING D_{100}
D_0 = 0.10765 D_{90} = 0.13564 D_{100} = 0.13875
C_v at 100.1 min. = 0.02 ft.^{2}/day

Pressure: 4.00 ksf — **TEST READINGS** — **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.15080	11	60.00	0.13800
2	0.10	0.14860	12	120.00	0.14600
3	0.25	0.14840	13	300.00	0.13300
4	0.50	0.14790			
5	1.00	0.14750			
6	2.00	0.14680			
7	4.00	0.14590			
8	8.00	0.14450			
9	15.00	0.14290			
10	30.00	0.14070			

Void Ratio = 0.592 **Compression** = 11.8 %

ressure: 1.00 ksf — TEST READINGS — Load No. 10

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.13300	11	1155.00	0.10450
2	0.10	0.13190			
3	0.25	0.13170			
4	0.50	0.13140			
5	1.00	0.13090			
6	4.00	0.12950			
7	8.00	0.12800			
8	15.00	0.12570			
9	60.00	0.12100			
10	120.00	0.11700			

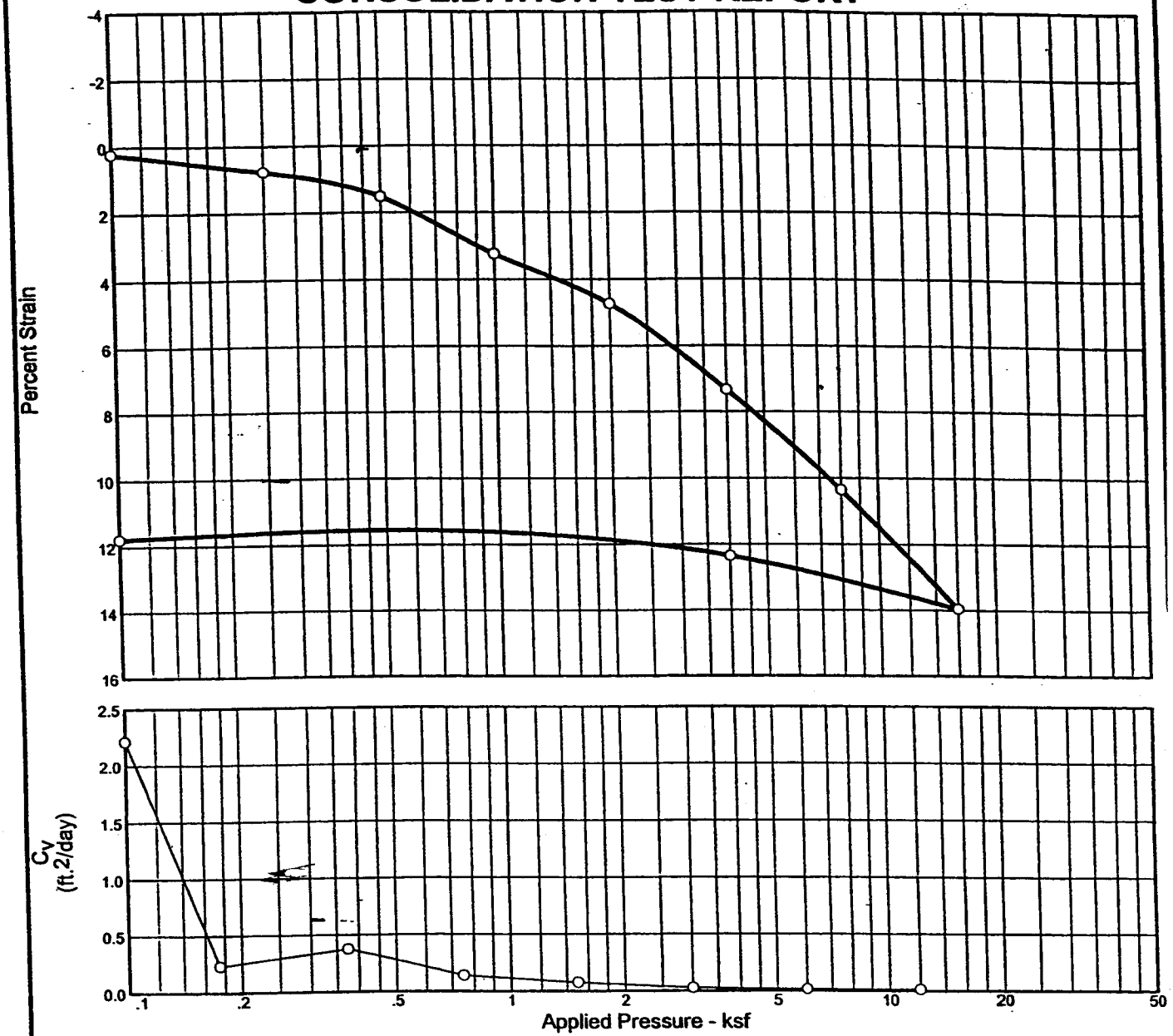
Void Ratio = 0.640 Compression = 9.2 %

ressure: 0.10 ksf — TEST READINGS — Load No. 11

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.10450	11	480.00	0.08400
2	0.10	0.10400			
3	0.25	0.10380			
4	0.50	0.10360			
5	1.00	0.10340			
6	2.00	0.10310			
7	4.00	0.10260			
8	8.00	0.10190			
9	15.00	0.10090			
10	30.00	0.09940			

Void Ratio = 0.675 Compression = 7.2 %

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Swell %	e_o
100.0 %	30.5 %	97.6	57	41.2	2.66		1.93	0.21	0.03			0.702

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 1131-99-588 **Client:** SHINER MOSELEY and ASSOCIATES

Project: SHOAL POINT TERMINAL

Source: boring# C-3 **Sample No.:** C-3 **Elev./Depth:** 13-15 ft.

Remarks:
98.1% Passing #200 Sieve

CONSOLIDATION TEST REPORT

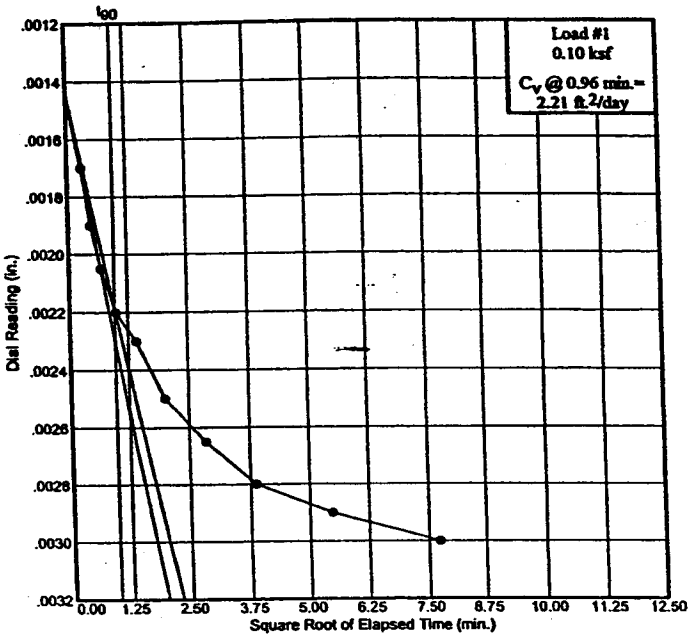
S & ME, Inc.

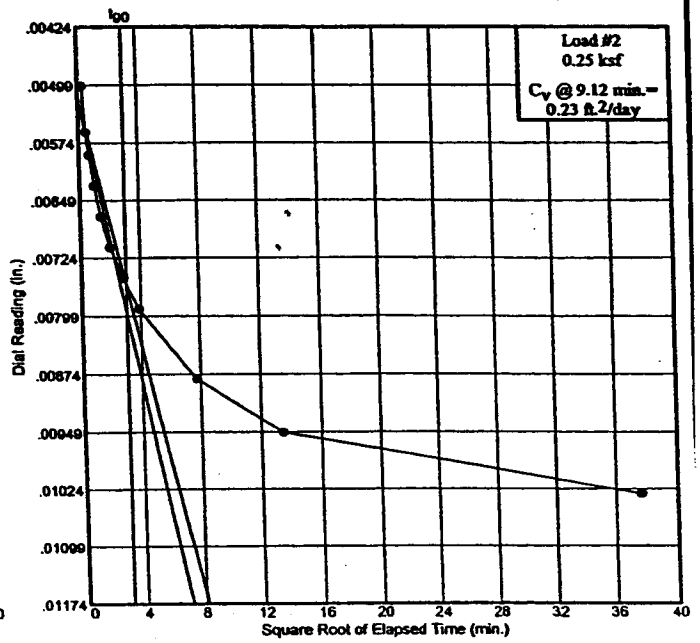
Plate

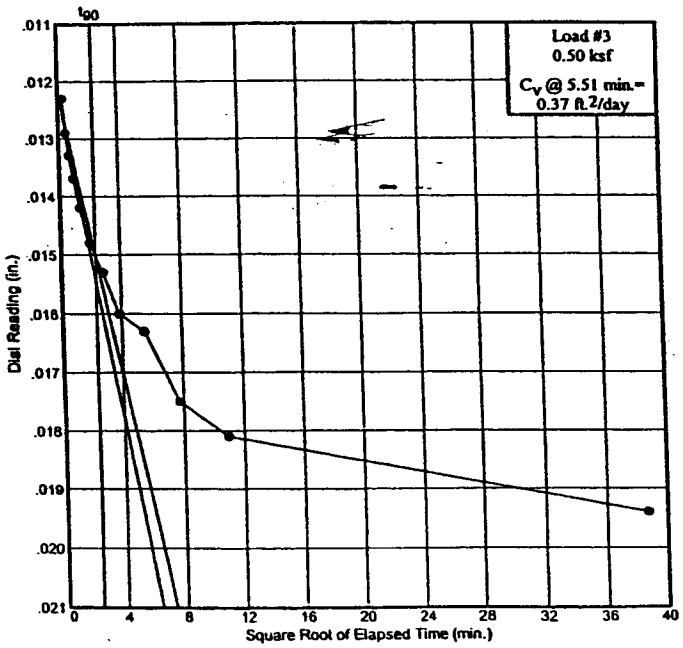
Dial Reading vs. Time

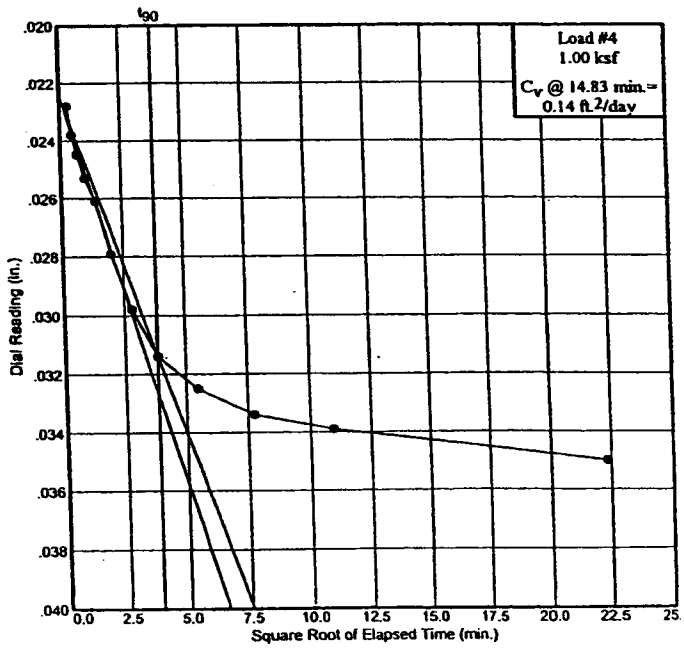
Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-3 Sample No.: C-3 Elev./Depth: 13-15 ft.









Dial Reading vs. Time

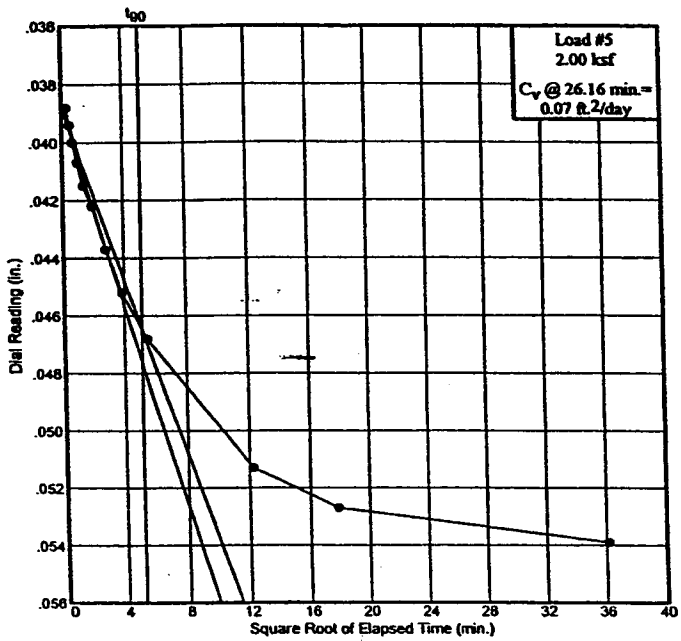
S & ME, Inc.

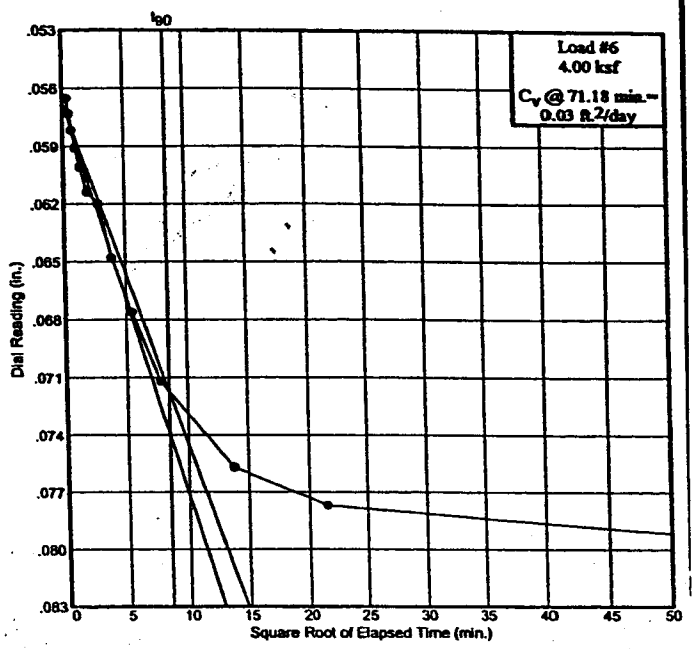
Plate

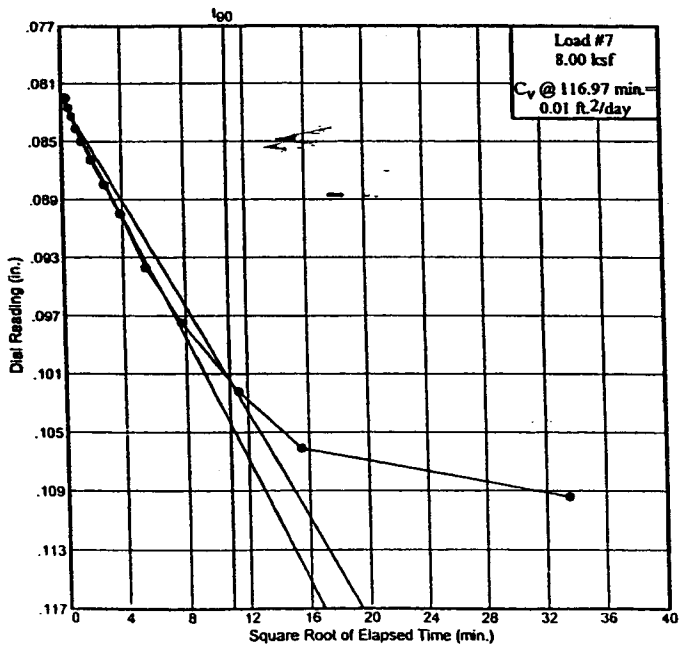
Dial Reading vs. Time

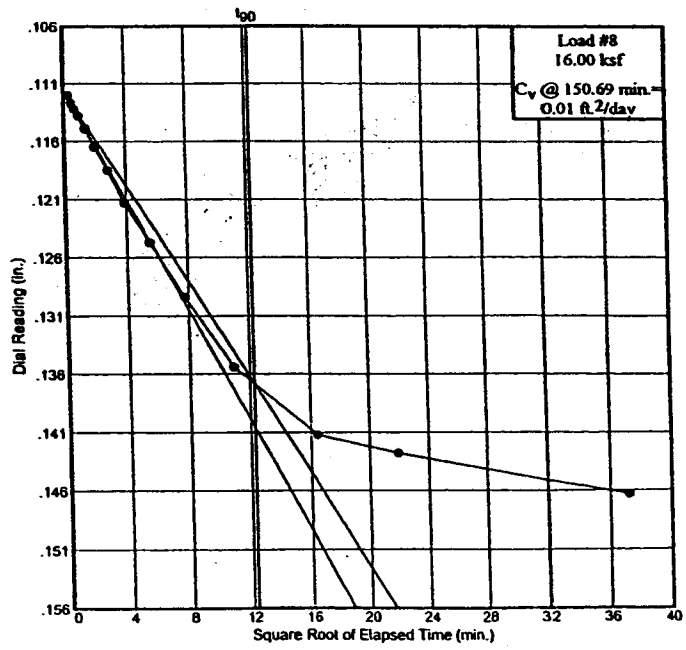
Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-3 Sample No.: C-3 Elev./Depth: 13-15 ft.









Dial Reading vs. Time

S & ME, Inc.

Plate

CONSOLIDATION TEST DATA

ıient: SHINER MOSELEY and ASSOCIATES
roject: SHOAL POINT TERMINAL
ɔject Number: 1131-99-588

Sample Data

urce: boring# C-3
ample No.: C-3
lev. or Depth: 13-15 ft. Sample Length (in./cm.):
cation:
scription:
iquid Limit: 57 Plasticity Index: 41.2
SCS: AASHTO: Figure No.:
sting Remarks: 98.1% Passing #200 Sieve

Test Specimen Data

TOTAL SAMPLE		BEFORE TEST	AFTER TEST
Wet w+t	= 35.10 g.	Consolidometer # = 3	Wet w+t = 269.73 g.
Dry w+t	= 26.90 g.		Dry w+t = 234.28 g.
Tare Wt.	= .00 g.	Spec. Gravity = 2.66	Tare Wt. = 108.48 g.
Height	= 1.00 in.	Height = 1.00 in.	
Diameter	= 2.50 in.	Diameter = 2.50 in.	
Weight	= 164.03 g.	Defl. Table = Reference Set (inches/psf)	
Moisture	= 30.5 %	Ht. Solids = 0.5875 in.	Moisture = 28.2 %
Wet Den.	= 127.3 pcf	Dry Wt. = 125.71 g.*	Dry Wt. = 125.80 g.
Dry Den.	= 97.6 pcf	Void Ratio = 0.702	Void Ratio = 0.502
		Saturation = 100.0 %	

Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	0.00000	- --			0.702	
0.10	0.00300	0.00000	2.21		0.698*	0.2 Comprs.*
0.25	0.01030	0.00000	0.23		0.689*	0.8 Comprs.*
0.50	0.01940	0.00000	0.37		0.676*	1.5 Comprs.*
1.00	0.03500	0.00000	0.14		0.647*	3.2 Comprs.*
2.00	0.05390	0.00000	0.07		0.622*	4.7 Comprs.*
4.00	0.07950	0.00000	0.03		0.577*	7.3 Comprs.*
8.00	0.10940	0.00000	0.01		0.526*	10.4 Comprs.*
16.00	0.14630	0.00000	0.01		0.464*	14.0 Comprs.*
4.00	0.13020	0.00000			0.492	12.4 Comprs.
0.10	0.12450	0.00000			0.502	11.8 Comprs.

*CALCULATED USING D_{100} INSTEAD OF FINAL READING

C_c = 0.21 P_c = 1.93 ksf C_r = 0.03

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00000	11	60.00	0.00300
2	0.10	0.00170			
3	0.25	0.00190			
4	0.50	0.00205			
5	1.00	0.00220			
6	2.00	0.00230			
7	4.00	0.00250			
8	8.00	0.00265			
9	15.00	0.00280			
10	30.00	0.00290			

Void Ratio = 0.698 Compression = 0.2 % >>> CALCULATED USING D_{100}
D_0 = 0.00143 D_{90} = 0.00219 D_{100} = 0.00227
C_v at 1.0 min. = 2.21 ft.^{2}/day

Pressure: 0.25 ksf — **TEST READINGS** — **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00300	11	180.00	0.00950
2	0.10	0.00500	12	1415.00	0.01030
3	0.25	0.00560			
4	0.50	0.00590			
5	1.00	0.00630			
6	2.00	0.00670			
7	4.00	0.00710			
8	8.00	0.00750			
9	15.00	0.00790			
10	60.00	0.00880			

Void Ratio = 0.689 Compression = 0.8 % >>> CALCULATED USING D_{100}
D_0 = 0.00514 D_{90} = 0.00757 D_{100} = 0.00784
C_v at 9.1 min. = 0.23 ft.^{2}/day

Pressure: 0.50 ksf — **TEST READINGS** — **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01030	11	60.00	0.01750
2	0.10	0.01230	12	120.00	0.01810
3	0.25	0.01290	13	1500.00	0.01940
4	0.50	0.01330			
5	1.00	0.01370			
6	2.00	0.01420			
7	4.00	0.01480			
8	8.00	0.01530			
9	15.00	0.01600			
10	30.00	0.01630			

Void Ratio = 0.676 Compression = 1.5 % >>> CALCULATED USING D_{100}
D_0 = 0.01214 D_{90} = 0.01501 D_{100} = 0.01533
C_v at 5.5 min. = 0.37 ft.^{2}/day

essure: 1.00 ksf — TEST READINGS — Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01940	11	60.00	0.03340
2	0.10	0.02280	12	120.00	0.03390
3	0.25	0.02380	13	500.00	0.03500
4	0.50	0.02450			
5	1.00	0.02530			
6	2.00	0.02610			
7	4.00	0.02790			
8	8.00	0.02980			
9	15.00	0.03140			
10	30.00	0.03250			

Void Ratio = 0.647 Compression = 3.2 % >>> CALCULATED USING D_{100}
D_0 = 0.02238 D_{90} = 0.03137 D_{100} = 0.03236
C_v at 14.8 min. = 0.14 ft.^{2}/day

ressure: 2.00 ksf — TEST READINGS — Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.03500	11	150.00	0.05130
2	0.10	0.03880	12	320.00	0.05270
3	0.25	0.03940	13	1310.00	0.05390
4	0.50	0.04000			
5	1.00	0.04070			
6	2.00	0.04150			
7	4.00	0.04220			
8	8.00	0.04370			
9	15.00	0.04520			
10	30.00	0.04680			

Void Ratio = 0.622 Compression = 4.7 % >>> CALCULATED USING D_{100}
D_0 = 0.03868 D_{90} = 0.04644 D_{100} = 0.04730
C_v at 26.2 min. = 0.07 ft.^{2}/day

ressure: 4.00 ksf — TEST READINGS — Load No. 6

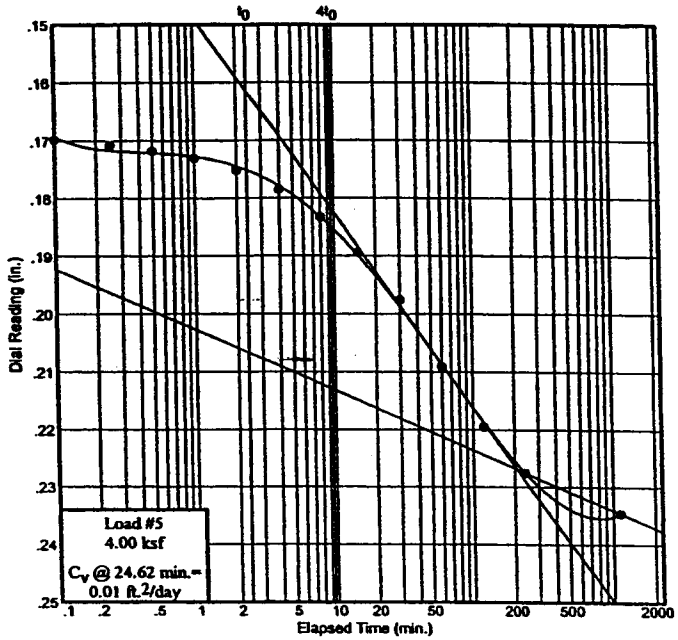
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.05390	11	60.00	0.07120
2	0.10	0.05650	12	190.00	0.07570
3	0.25	0.05730	13	465.00	0.07770
4	0.50	0.05820	14	3195.00	0.07950
5	1.00	0.05910			
6	2.00	0.06010			
7	4.00	0.06140			
8	8.00	0.06200			
9	15.00	0.06480			
10	30.00	0.06760			

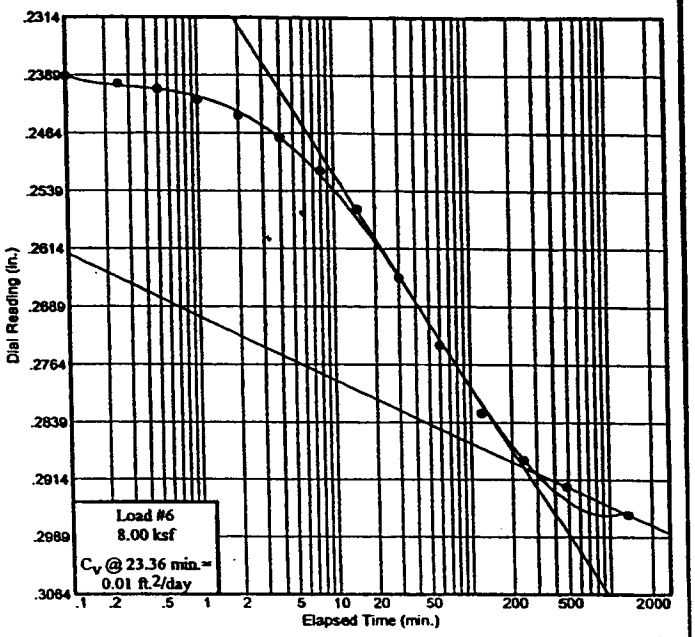
Void Ratio = 0.577 Compression = 7.3 % >>> CALCULATED USING D_{100}
D_0 = 0.05664 D_{90} = 0.07172 D_{100} = 0.07339
C_v at 71.2 min. = 0.03 ft.^{2}/day

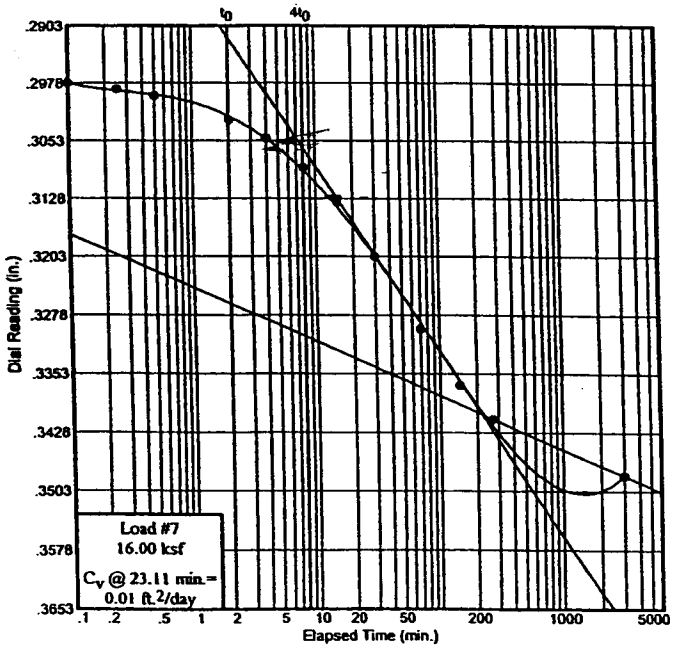
Dial Reading vs. Time

Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-5 Sample No.: C-5 Elev./Depth: 6 to 8 ft.







Dial Reading vs. Time

S & ME, Inc.

Plate

CONSOLIDATION TEST DATA

ient: SHINER MOSELEY and ASSOCIATES
oject: SHOAL POINT TERMINAL
oject Number: 1131-99-588

Sample Data

urce: boring# C-5
mple No.: C-5
lev. or Depth: 6 to 8 ft. Sample Length (in./cm.):
cation:
scription:
iquid Limit: 61 Plasticity Index: 41.1
CS: AASHTO: Figure No.:
sting Remarks: 89.1 % Pa ing # 200 sieve

Test Specimen Data

TOTAL SAMPLE		BEFORE TEST	AFTER TEST
et w+t	= 28.20 g.	Consolidometer # = 2	Wet w+t = 224.61 g.
y w+t	= 18.40 g.		Dry w+t = 196.61 g.
re Wt.	= .00 g.	Spec. Gravity = 2.67	Tare Wt. = 110.05 g.
eight	= 1.00 in.	Height = 1.00 in.	
iameter	= 2.50 in.	Diameter = 2.50 in.	
eight	= 137.02 g.	Defl. Table = Reference Set (inches/ksf)	
oisture	= 53.3 %	Ht. Solids = 0.4163 in.	Moisture = 32.4 %
et Den.	= 106.3 pcf	Dry Wt. = 89.40 g.*	Dry Wt. = 86.56 g.
y Den.	= 69.4 pcf	Void Ratio = 1.402	Void Ratio = 0.753
		Saturation = 100.0 %	

Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	0.00000	- -			1.402	
0.25	0.01100	0.00000	0.10	0.003	1.384*	0.8 Comprs.*
0.50	0.04360	0.00040	0.01	0.008	1.312*	3.8 Comprs.*
1.00	0.08240	0.00080	0.04	0.014	1.224*	7.4 Comprs.*
2.00	0.17000	0.00160	0.02	0.011	1.024*	15.8 Comprs.*
4.00	0.23700	0.00240	0.01	0.013	0.857*	22.7 Comprs.*
8.00	0.29600	0.00000	0.01	0.011	0.706*	29.0 Comprs.*
16.00	0.34830	0.00000	0.01	0.010	0.584*	34.1 Comprs.*
4.00	0.33430	0.00300			0.625	32.4 Comprs.
1.00	0.31810	0.00080			0.659	31.0 Comprs.
0.10	0.27820	0.00000			0.753	27.0 Comprs.

*CALCULATED USING D_{100} INSTEAD OF FINAL READING

C_c = 0.62 P_c = 0.97 ksf C_r = 0.07

Pressure: 0.25 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00000	11	60.00	0.00750
2	0.10	0.00120	12	1500.00	0.01100
3	0.25	0.00140			
4	0.50	0.00170			
5	1.00	0.00220			
6	2.00	0.00270			
7	4.00	0.00350			
8	8.00	0.00430			
9	15.00	0.00530			
10	30.00	0.00640			

Void Ratio = 1.384 Compression = 0.8 % >>> CALCULATED USING D_{100}
D_0 = 0.00000 D_{50} = 0.00374 D_{100} = 0.00748
C_v at 5.0 min. = 0.10 ft.^{2}/day C_α = 0.003

Pressure: 0.50 ksf — **TEST READINGS** — **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01100	11	60.00	0.02880
2	0.10	0.01170	12	120.00	0.03340
3	0.25	0.01230	13	490.00	0.03980
4	0.50	0.01270	14	1445.00	0.04360
5	1.00	0.01340			
6	2.00	0.01440			
7	4.00	0.01590			
8	8.00	0.01800			
9	15.00	0.02090			
10	30.00	0.02230			

Void Ratio = 1.312 Compression = 3.8 % >>> CALCULATED USING D_{100}
D_0 = 0.01100 D_{50} = 0.02427 D_{100} = 0.03754
C_v at 33.1 min. = 0.01 ft.^{2}/day C_α = 0.008

Pressure: 1.00 ksf — **TEST READINGS** — **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.04360	11	140.00	0.07770
2	0.10	0.04530	12	315.00	0.08240
3	0.25	0.04580			
4	0.50	0.04650			
5	1.00	0.04780			
6	2.00	0.04940			
7	4.00	0.05300			
8	8.00	0.05600			
9	20.00	0.06310			
10	30.00	0.06690			

Void Ratio = 1.224 Compression = 7.4 % >>> CALCULATED USING D_{100}
D_0 = 0.04320 D_{50} = 0.05878 D_{100} = 0.07436
C_v at 12.4 min. = 0.04 ft.^{2}/day C_α = 0.014

'ressure: 2.00 ksf — TEST READINGS — Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.08240	11	60.00	0.13100
2	0.10	0.08950	12	180.00	0.15470
3	0.25	0.09020	13	445.00	0.16110
4	0.50	0.09100	14	3195.00	0.17000
5	1.00	0.09250			
6	2.00	0.09480			
7	4.00	0.09820			
8	8.00	0.11350			
9	15.00	0.11950			
10	30.00	0.12890			

Void Ratio = 1.024 Compression = 15.8 % >>> CALCULATED USING D_{100}
D_0 = 0.08093 D_{50} = 0.11930 D_{100} = 0.15767
C_v at 19.5 min. = 0.02 ft.^{2}/day C_α = 0.011

Pressure: 4.00 ksf — TEST READINGS — Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.17000	11	60.00	0.21140
2	0.10	0.17220	12	120.00	0.22190
3	0.25	0.17320	13	240.00	0.23000
4	0.50	0.17420	14	1125.00	0.23700
5	1.00	0.17550			
6	2.00	0.17760			
7	4.00	0.18090			
8	8.00	0.18570			
9	15.00	0.19180			
10	30.00	0.20000			

Void Ratio = 0.857 Compression = 22.7 % >>> CALCULATED USING D_{100}
D_0 = 0.16533 D_{50} = 0.19615 D_{100} = 0.22696
C_v at 24.6 min. = 0.01 ft.^{2}/day C_α = 0.013

Pressure: 8.00 ksf — TEST READINGS — Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.23700	11	60.00	0.27390
2	0.10	0.23900	12	120.00	0.28270
3	0.25	0.24000	13	240.00	0.28890
4	0.50	0.24070	14	480.00	0.29230
5	1.00	0.24210	15	1355.00	0.29600
6	2.00	0.24410			
7	4.00	0.24700			
8	8.00	0.25130			
9	15.00	0.25630			
10	30.00	0.26520			

Void Ratio = 0.706 Compression = 29.0 % >>> CALCULATED USING D_{100}
D_0 = 0.23460 D_{50} = 0.26221 D_{100} = 0.28982
C_v at 23.4 min. = 0.01 ft.^{2}/day C_α = 0.011

Pressure: 16.00 ksf — **TEST READINGS** — **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.29600	11	145.00	0.33680
2	0.10	0.29780	12	270.00	0.34110
3	0.25	0.29860	13	2995.00	0.34830
4	0.50	0.29950			
5	2.00	0.30260			
6	4.00	0.30500			
7	8.00	0.30880			
8	15.00	0.31330			
9	30.00	0.32030			
10	70.00	0.32960			

Void Ratio = 0.584 Compression = 34.1 % >>> CALCULATED USING D_{100}
D_0 = 0.29507 D_{50} = 0.31776 D_{100} = 0.34045
C_v at 23.1 min. = 0.01 ft.^{2}/day C_α = 0.010

Pressure: 4.00 ksf — **TEST READINGS** — **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.34830	11	60.00	0.33690
2	0.10	0.34630	12	205.00	0.33530
3	0.25	0.34600	13	445.00	0.33480
4	0.50	0.34560	14	1385.00	0.33430
5	1.00	0.34510			
6	2.00	0.34440			
7	4.00	0.34340			
8	8.00	0.34200			
9	15.00	0.34060			
10	30.00	0.33930			

Void Ratio = 0.625 Compression = 32.4 %

Pressure: 1.00 ksf — **TEST READINGS** — **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.33430	11	95.00	0.32130
2	0.10	0.33330	12	165.00	0.31810
3	0.25	0.33315			
4	0.50	0.33280			
5	1.00	0.33250			
6	2.00	0.33190			
7	4.00	0.33110			
8	8.00	0.33030			
9	15.00	0.32850			
10	30.00	0.32665			

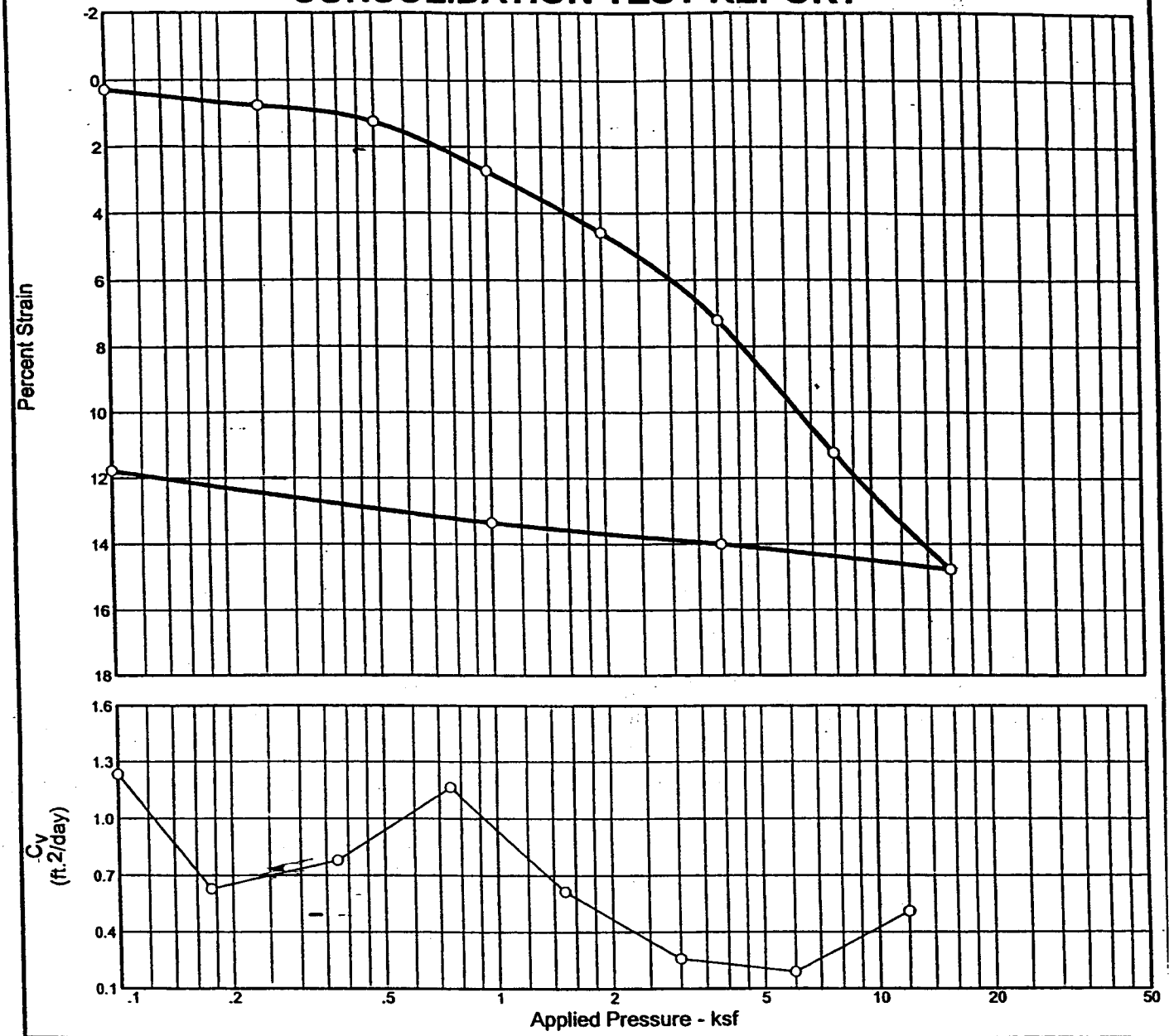
Void Ratio = 0.659 Compression = 31.0 %

ressure: 0.10 ksf | TEST READINGS | Load No. 10

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.31810	11	60.00	0.30240
2	0.10	0.31000	12	155.00	0.29670
3	0.25	0.30980	13	290.00	0.29180
4	0.50	0.30970	14	1440.00	0.27820
5	1.00	0.30950			
6	2.00	0.30920			
7	4.00	0.30870			
8	8.00	0.30770			
9	15.00	0.30600			
10	30.00	0.30520			

Void Ratio = 0.753 Compression = 27.0 %

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Swell %	e_o
97.0 %	30.5 %	90.6	32.8	18.1	2.67		1.37	0.22	0.01			0.840

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 1131-99-588 **Client:** SHINER MOSELEY and ASSOCIATES

Project: SHOAL POINT TERMINAL

Source: boring# C-8 **Sample No.:** C-8 **Elev./Depth:** 28-30 FT.

Remarks:
59.5 % Passing # 200 sieve

CONSOLIDATION TEST REPORT

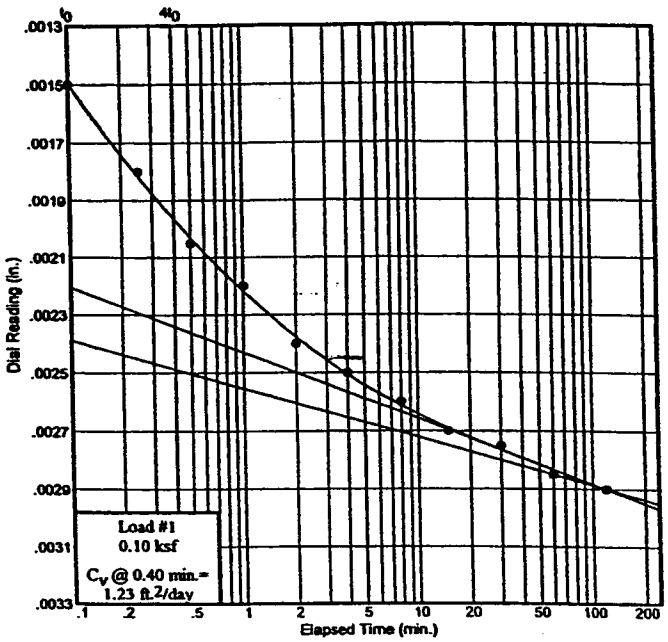
S & ME, Inc.

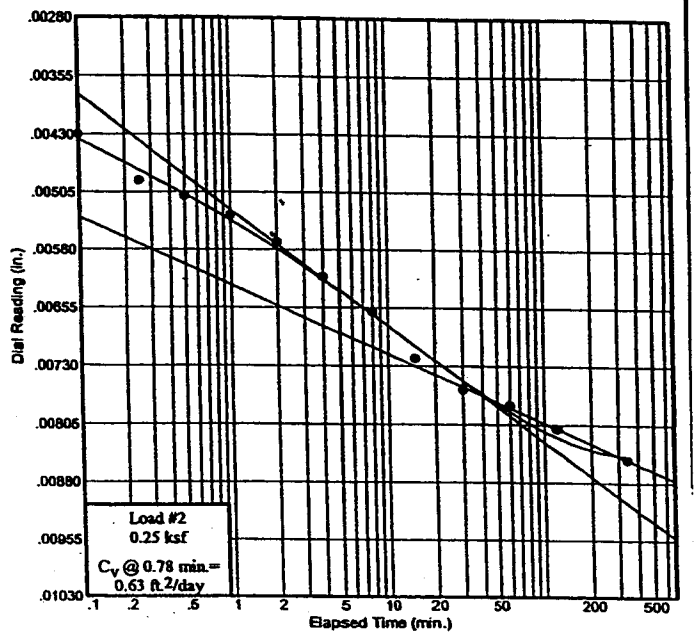
Plate

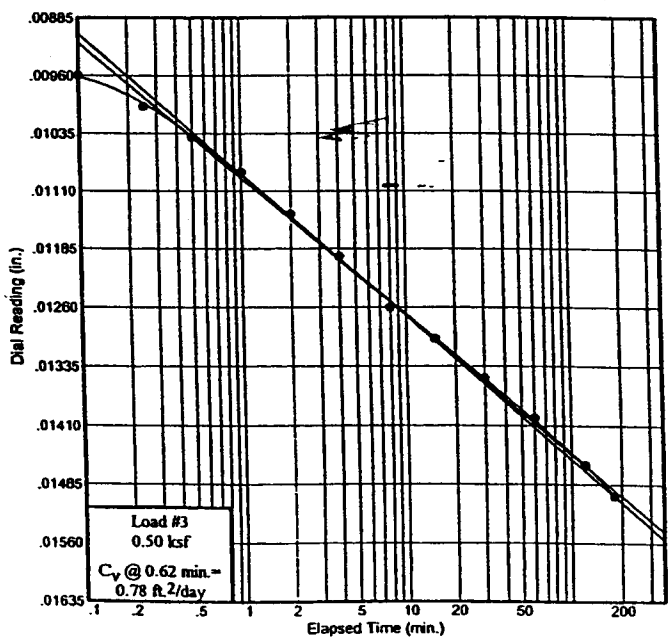
Dial Reading vs. Time

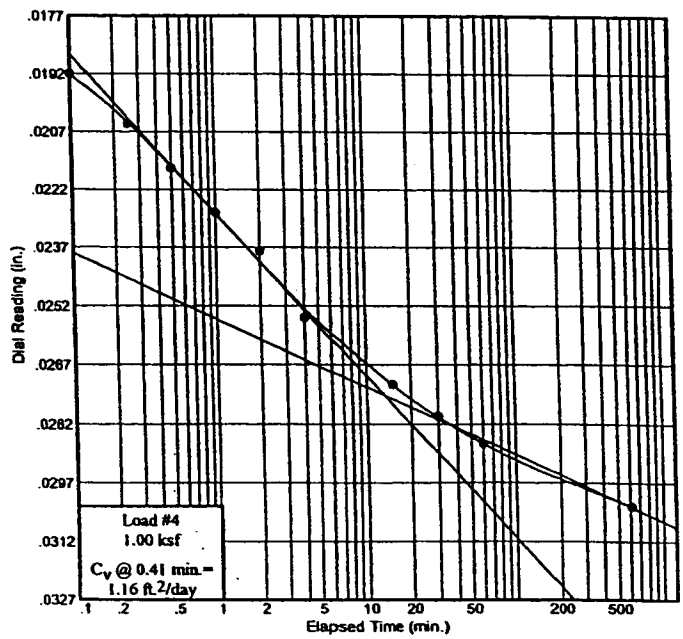
Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-8 Sample No.: C-8 Elev./Depth: 28-30 FT.









Dial Reading vs. Time

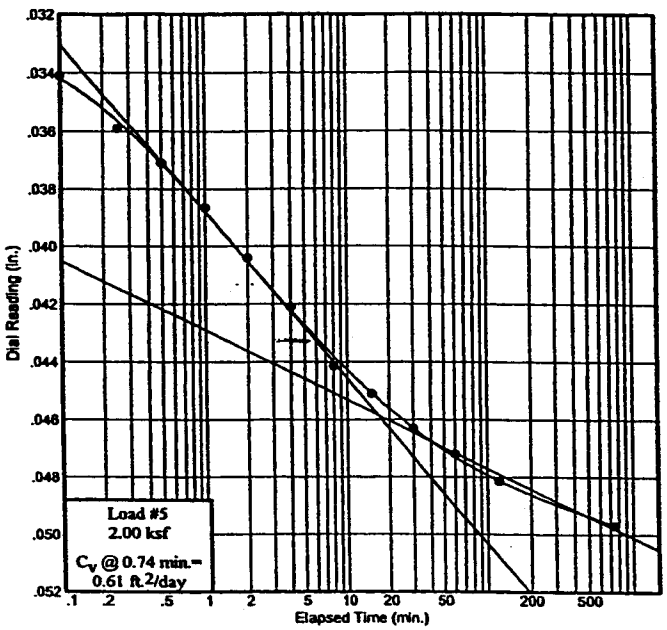
S & ME, Inc.

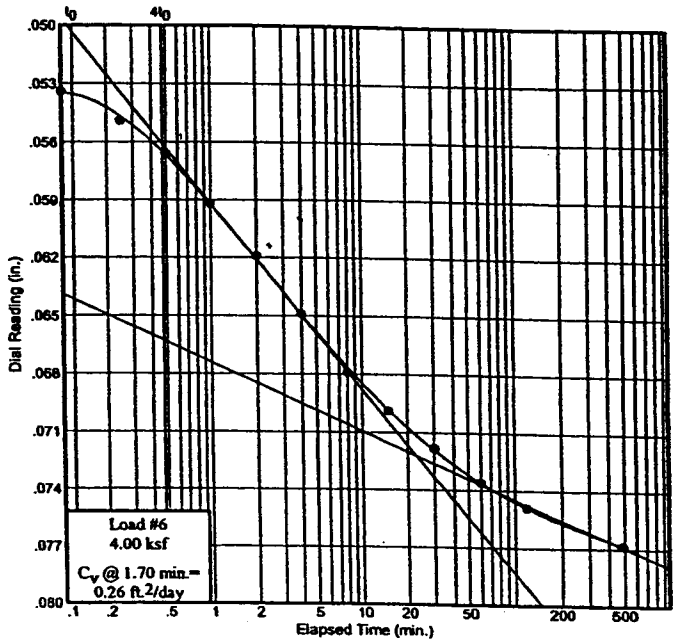
Plate

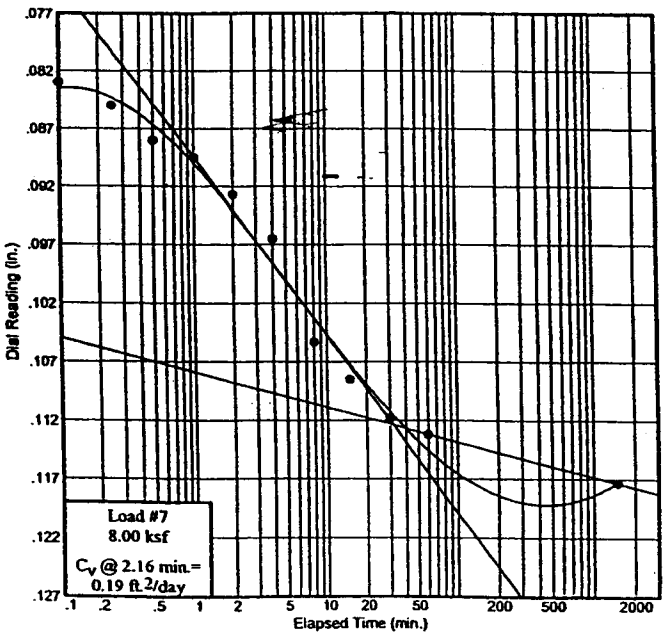
Dial Reading vs. Time

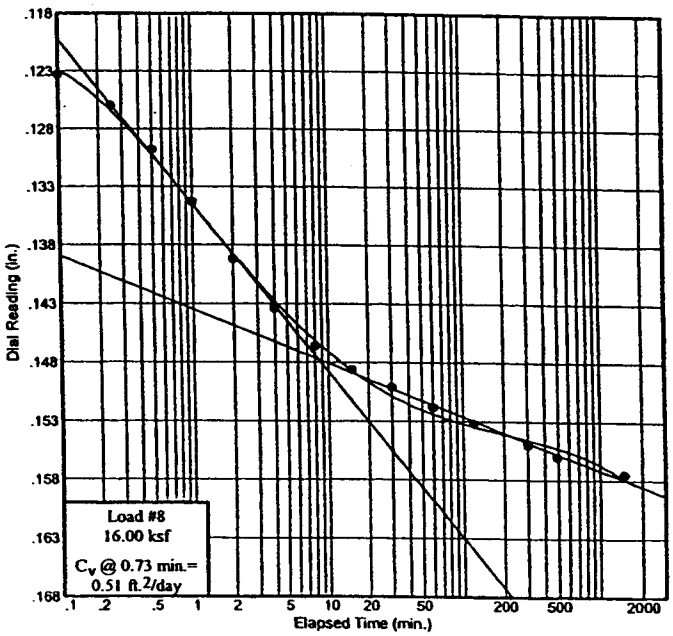
Project No.: 1131-99-588
Project: SHOAL POINT TERMINAL

Source: boring# C-8 Sample No.: C-8 Elev./Depth: 28-30 FT.









Dial Reading vs. Time

S & ME, Inc.

Plate

CONSOLIDATION TEST DATA

lient: SHINER MOSELEY and ASSOCIATES
roject: SHOAL POINT TERMINAL
roject Number: 1131-99-588

Sample Data

ource: boring# C-8
ample No.: C-8
lev. or Depth: 28-30 FT. Sample Length (in./cm.):
ocation:
escription:
iquid Limit: 32.8 Plasticity Index: 18.1
SCS: AASHTO: Figure No.:
esting Remarks: 59.5 % Passing # 200 sieve

Test Specimen Data

TOTAL SAMPLE		BEFORE TEST	AFTER TEST
Wet w+t	= 96.60 g.	Consolidometer # = 2	Wet w+t = 255.57 g.
Dry w+t	= 74.00 g.		Dry w+t = 226.75 g.
Tare Wt.	= .00 g.	Spec. Gravity = 2.67	Tare Wt. = 110.05 g.
Height	= 1.00 in.	Height = 1.00 in.	
Diameter	= 2.50 in.	Diameter = 2.50 in.	
Weight	= 152.35 g.	Defl. Table = Reference Set (inches/ksf)	
Moisture	= 30.5 %	Ht. Solids = 0.5434 in.	Moisture = 24.7 %
Wet Den.	= 118.2 pcf	Dry Wt. = 116.71 g.*	Dry Wt. = 116.70 g.
Dry Den.	= 90.6 pcf	Void Ratio = 0.840	Void Ratio = 0.623
		Saturation = 97.0 %	

* Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	0.00000				0.840	
0.10	0.00290	0.00000	1.23	0.000	0.835*	0.3 Comprs.
0.25	0.00850	0.00000	0.63	0.001	0.826*	0.8 Comprs.
0.50	0.01540	0.00040	0.78	0.002	0.817*	1.3 Comprs.
1.00	0.03110	0.00080	1.16	0.002	0.790*	2.8 Comprs.
2.00	0.05130	0.00160	0.61	0.002	0.756*	4.6 Comprs.
4.00	0.07925	0.00240	0.26	0.004	0.707*	7.2 Comprs.
8.00	0.11735	0.00000	0.19	0.003	0.633*	11.2 Comprs.
16.00	0.15750	0.00000	0.51	0.005	0.568*	14.8 Comprs.
4.00	0.15280	0.00300			0.583	14.0 Comprs.
1.00	0.14410	0.00080			0.595	13.4 Comprs.
0.10	0.12760	0.00000			0.623	11.8 Comprs.

*CALCULATED USING D_{100} INSTEAD OF FINAL READING

C_c = 0.22 P_c = 1.37 ksf C_r = 0.01

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00000	11	60.00	0.00285
2	0.10	0.00150	12	120.00	0.00290
3	0.25	0.00180			
4	0.50	0.00205			
5	1.00	0.00220			
6	2.00	0.00240			
7	4.00	0.00250			
8	8.00	0.00260			
9	15.00	0.00270			
10	30.00	0.00275			

Void Ratio = 0.835 Compression = 0.3 % >>> CALCULATED USING D_{100}
D_0 = 0.00103 D_{50} = 0.00196 D_{100} = 0.00290
C_v at 0.4 min. = 1.23 ft.^{2}/day C_α = 0.000

Pressure: 0.25 ksf — **TEST READINGS** — **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00290	11	60.00	0.00780
2	0.10	0.00430	12	120.00	0.00810
3	0.25	0.00490	13	340.00	0.00850
4	0.50	0.00510			
5	1.00	0.00535			
6	2.00	0.00570			
7	4.00	0.00615			
8	8.00	0.00660			
9	15.00	0.00720			
10	30.00	0.00760			

Void Ratio = 0.826 Compression = 0.8 % >>> CALCULATED USING D_{100}
D_0 = 0.00290 D_{50} = 0.00529 D_{100} = 0.00768
C_v at 0.8 min. = 0.63 ft.^{2}/day C_α = 0.001

Pressure: 0.50 ksf — **TEST READINGS** — **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00850	11	60.00	0.01440
2	0.10	0.01000	12	120.00	0.01500
3	0.25	0.01040	13	180.00	0.01540
4	0.50	0.01080			
5	1.00	0.01125			
6	2.00	0.01180			
7	4.00	0.01235			
8	8.00	0.01300			
9	15.00	0.01340			
10	30.00	0.01390			

Void Ratio = 0.817 Compression = 1.3 % >>> CALCULATED USING D_{100}
D_0 = 0.00850 D_{50} = 0.01053 D_{100} = 0.01257
C_v at 0.6 min. = 0.78 ft.^{2}/day C_α = 0.002

Pressure: 1.00 ksf — TEST READINGS — Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.01540	11	615.00	0.03110
2	0.10	0.02000			
3	0.25	0.02130			
4	0.50	0.02245			
5	1.00	0.02360			
6	2.00	0.02460			
7	4.00	0.02630			
8	15.00	0.02800			
9	30.00	0.02880			
10	60.00	0.02950			

Void Ratio = 0.790 Compression = 2.8 % >>> CALCULATED USING D_{100}
D_0 = 0.01500 D_{50} = 0.02123 D_{100} = 0.02747
C_v at 0.4 min. = 1.16 ft.^{2}/day C_α = 0.002

Pressure: 2.00 ksf — TEST READINGS — Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.03110	11	60.00	0.04880
2	0.10	0.03570	12	120.00	0.04975
3	0.25	0.03750	13	750.00	0.05130
4	0.50	0.03870			
5	1.00	0.04025			
6	2.00	0.04200			
7	4.00	0.04370			
8	8.00	0.04575			
9	15.00	0.04670			
10	30.00	0.04790			

Void Ratio = 0.756 Compression = 4.6 % >>> CALCULATED USING D_{100}
D_0 = 0.03030 D_{50} = 0.03807 D_{100} = 0.04584
C_v at 0.7 min. = 0.61 ft.^{2}/day C_α = 0.002

Pressure: 4.00 ksf — TEST READINGS — Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.05130	11	60.00	0.07600
2	0.10	0.05580	12	120.00	0.07730
3	0.25	0.05730	13	485.00	0.07925
4	0.50	0.05900			
5	1.00	0.06160			
6	2.00	0.06430			
7	4.00	0.06730			
8	8.00	0.07030			
9	15.00	0.07230			
10	30.00	0.07420			

Void Ratio = 0.707 Compression = 7.2 % >>> CALCULATED USING D_{100}
D_0 = 0.05059 D_{50} = 0.06140 D_{100} = 0.07221
C_v at 1.7 min. = 0.26 ft.^{2}/day C_α = 0.004

Pressure: 8.00 ksf — **TEST READINGS** — **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.07925	11	60.00	0.11320
2	0.10	0.08300	12	1490.00	0.11735
3	0.25	0.08500			
4	0.50	0.08800			
5	1.00	0.08950			
6	2.00	0.09270			
7	4.00	0.09650			
8	8.00	0.10530			
9	15.00	0.10850			
10	30.00	0.11180			

Void Ratio = 0.633 Compression = 11.2 % >>> CALCULATED USING D_{100}
D_0 = 0.07685 D_{50} = 0.09461 D_{100} = 0.11238
C_v at 2.2 min. = 0.19 ft.^{2}/day C_α = 0.003

Pressure: 16.00 ksf — **TEST READINGS** — **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.11735	11	60.00	0.15180
2	0.10	0.12330	12	120.00	0.15320
3	0.25	0.12600	13	300.00	0.15500
4	0.50	0.12980	14	490.00	0.15600
5	1.00	0.13430	15	1475.00	0.15750
6	2.00	0.13920			
7	4.00	0.14340			
8	8.00	0.14660			
9	15.00	0.14860			
10	30.00	0.15010			

Void Ratio = 0.568 Compression = 14.8 % >>> CALCULATED USING D_{100}
D_0 = 0.11735 D_{50} = 0.13254 D_{100} = 0.14774
C_v at 0.7 min. = 0.51 ft.^{2}/day C_α = 0.005

Pressure: 4.00 ksf — **TEST READINGS** — **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.15750	11	415.00	0.15280
2	0.10	0.15450			
3	0.25	0.15430			
4	0.50	0.15400			
5	1.00	0.15365			
6	2.00	0.15340			
7	4.00	0.15330			
8	8.00	0.15320			
9	15.00	0.15310			
10	30.00	0.15300			

Void Ratio = 0.583 Compression = 14.0 %

ressure: 1.00 ksf — TEST READINGS — Load No. 10

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.15280	11	100.00	0.14410
2	0.10	0.15070			
3	0.25	0.15030			
4	0.50	0.14970			
5	1.00	0.14885			
6	2.00	0.14785			
7	4.00	0.14670			
8	8.00	0.14580			
9	15.00	0.14500			
10	30.00	0.14460			

Void Ratio = 0.595 Compression = 13.4 %

ressure: 0.10 ksf — TEST READINGS — Load No. 11

No.	Elapsed Time	Dial Reading
1	0.00	0.14410
2	0.10	0.14320
3	0.25	0.14280
4	0.50	0.14230
5	1.00	0.14140
6	2.00	0.14015
7	4.00	0.13850
8	8.00	0.13680
9	15.00	0.13480
10	1080.00	0.12760

Void Ratio = 0.623 Compression = 11.8 %

LABORATORY INDEX PROPERTY TESTING PROCEDURES

Moisture Content Test (ASTM D-2216)

Moisture content tests were conducted to determine the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of the solid particles.

Grain Size Tests (ASTM D-1140 and ASTM D-422)

Grain size tests were performed to determine the soil particle size distribution. The amount of material finer than the #200 sieve was determined by washing the sample over that particular size sieve. The grain size distribution of the soil retained on the #200 sieve was then determined by passing the retained portion through a standard set of nested sieves.

Atterberg Limits Test (ASTM D-4318)

Atterberg Limits tests were performed to determine the soil plasticity characteristics. The soil plasticity index (PI) is representative of this characteristic and is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil will flow as a heavy viscous fluid. The plastic limit is the moisture content at which the soil begins to lose its plasticity. The difference between the liquid limit and plastic limit is the plasticity index.

LABORATORY CONSOLIDATION and STRENGTH TESTING PROCEDURES

Consolidation Tests

Consolidation is a process of soil mass volume change cause by load application. The change in soil volume is accomplished by a relief in hydrostatic pore pressure within the soil mass as the soil mass drains and adjusts to a new loading condition.

For each consolidation test, a section of undisturbed sample is extruded from a sampling tube. The sample is then trimmed in to a disc 2.4 inches in diameter and 1 inch thick. The disc is confined in a stainless steel ring between porous plates and subjected to incrementally increasing vertical loads. The resulting deformations are measured with a micrometer dial gauge.

Unconfined Compression Test

The unconfined compression test is performed on fine-grained soils to estimate the shear strength. This test is considered a special case of the unconsolidated-undrained triaxial test with the confining pressure equal to zero (atmospheric). The deviator stress at failure is the unconfined compression strength, and the shear strength (cohesion) is one-half of this value.

Triaxial Test

Soil shear strength parameters of cohesion and internal friction are typically used in geotechnical engineering analyses of slope stability, bearing capacity, and lateral earth pressure.

The triaxial shear test is performed by preparing a cylindrical soil specimen which is covered by a thin membrane. The soil sample is encased inside a triaxial cell beneath an axial loading piston. To simulate lateral confinement, a hydrostatic pressure is applied to the sample by pressurizing the triaxial cell. Following the application of confining pressure, shear stresses are created in the sample by application of a vertical load through the piston. To obtain Mohr's envelope, several triaxial tests are performed on specimens of the same soil while varying the cell pressures.

There are three conditions under which triaxial shear tests are performed: Unconsolidated-undrained, consolidated-undrained and consolidated-drained. Each of these three loading conditions are used to simulate the effect of pore water pressure created by site-specific loading conditions.

APPENDIX IV

LEAST COST PER ACRE EARTHWORK ESTIMATES

LEAST COST PER ACRE EARTHWORK ESTIMATES
CELL C CONTAINER YARD
PROPOSED SHOAL POINT TERMINAL
S&ME Job #1131-99-588

Item	Unit	Quantity
Fill Cost	CY	$6.00
Surcharge Removal Cost	CY	$1.50
Wick Drains	LF	$0.50
Drainage System	LS	$150,000
Undercutting & Disposal of Spoil	CY	$2.00
Undercutting & Replacement of Fill	CY	$2.50
Geosynthetic Layer	SY	$2.50

2-INCH POST CONSTRUCTION SETTLEMENT CRITERIA

Container Yard Elevation	Surcharge Period (yrs)	Permanent Fill (cy)	Surcharge Fill (cy)	Wick Drains (ft)	Spoil Undercut (cy)	Fill Undercut (cy)	Permanent Fill	Surcharge Placement	Surcharge Removal	Wick Drains	Spoil Undercutting	Fill Undercutting & Backfilling	Geosynthetic Layer	Drainage System	Per Acre Bid Costs
18 NAVD '88	1	4,840	15,811	40,039	3,485	1,355	$29,040	$94,864	$23,716	$20,019	$6,970	$3,388	$12,100	$1,500	$191,597
18 NAVD '88	2	4,840	14,972	24,200	3,485	1,355	$29,040	$89,830	$22,458	$12,100	$6,970	$3,388	$12,100	$1,500	$177,386

3-INCH POST CONSTRUCTION SETTLEMENT CRITERIA

Container Yard Elevation	Surcharge Period (yrs)	Permanent Fill (cy)	Surcharge Fill (cy)	Wick Drains (ft)	Spoil Undercut (cy)	Fill Undercut (cy)	Permanent Fill	Surcharge Placement	Surcharge Removal	Wick Drains	Spoil Undercutting	Fill Undercutting & Backfilling	Geosynthetic Layer	Drainage System	Per Acre Bid Costs
18 NAVD '88	1	4,840	14,326	40,039	3,630	1,210	$29,040	$85,958	$21,490	$20,019	$7,260	$3,025	$12,100	$1,500	$180,392
18 NAVD '88	2	4,840	13,487	24,200	3,630	1,210	$29,040	$80,925	$20,231	$12,100	$7,260	$3,025	$12,100	$1,500	$168,181

5-INCH POST CONSTRUCTION SETTLEMENT CRITERIA

Container Yard Elevation	Surcharge Period (yrs)	Permanent Fill (cy)	Surcharge Fill (cy)	Wick Drains (ft)	Spoil Undercut (cy)	Fill Undercut (cy)	Permanent Fill	Surcharge Placement	Surcharge Removal	Wick Drains	Spoil Undercutting	Fill Undercutting & Backfilling	Geosynthetic Layer	Drainage System	Per Acre Bid Costs
18 NAVD '88	1	4,840	11,358	40,039	3,937	903	$29,040	$68,147	$17,037	$20,019	$7,873	$2,259	$12,100	$1,500	$157,975
18 NAVD '88	2	4,840	10,906	24,200	3,920	920	$29,040	$65,437	$16,359	$12,100	$7,841	$2,299	$12,100	$1,500	$146,676

9-INCH POST CONSTRUCTION SETTLEMENT CRITERIA

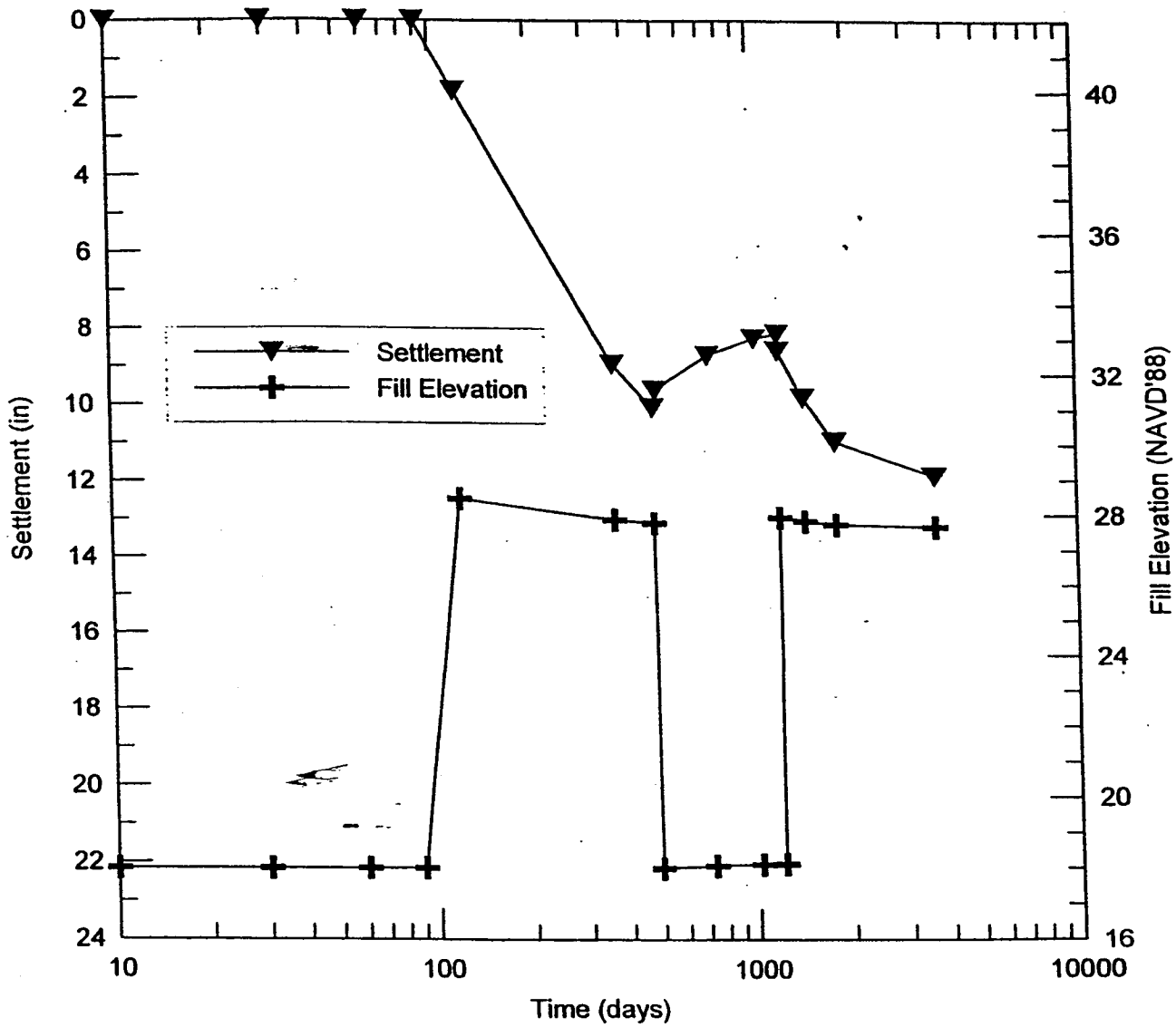
Container Yard Elevation	Surcharge Period (yrs)	Permanent Fill (cy)	Surcharge Fill (cy)	Wick Drains (ft)	Spoil Undercut (cy)	Fill Undercut (cy)	Permanent Fill	Surcharge Placement	Surcharge Removal	Wick Drains	Spoil Undercutting	Fill Undercutting & Backfilling	Geosynthetic Layer	Drainage System	Per Acre Bid Costs
18 NAVD '88	1	4,840	6,986	24,200	4,501	339	$29,040	$41,914	$10,479	$12,100	$9,002	$847	$12,100	$1,500	$116,982
18 NAVD '88	2	4,840	6,195	24,200	4,533	307	$29,040	$37,171	$9,293	$12,100	$9,067	$766	$12,100	$1,500	$111,037

NOTES: No salvage value has been assigned to the surcharge material.

APPENDIX V

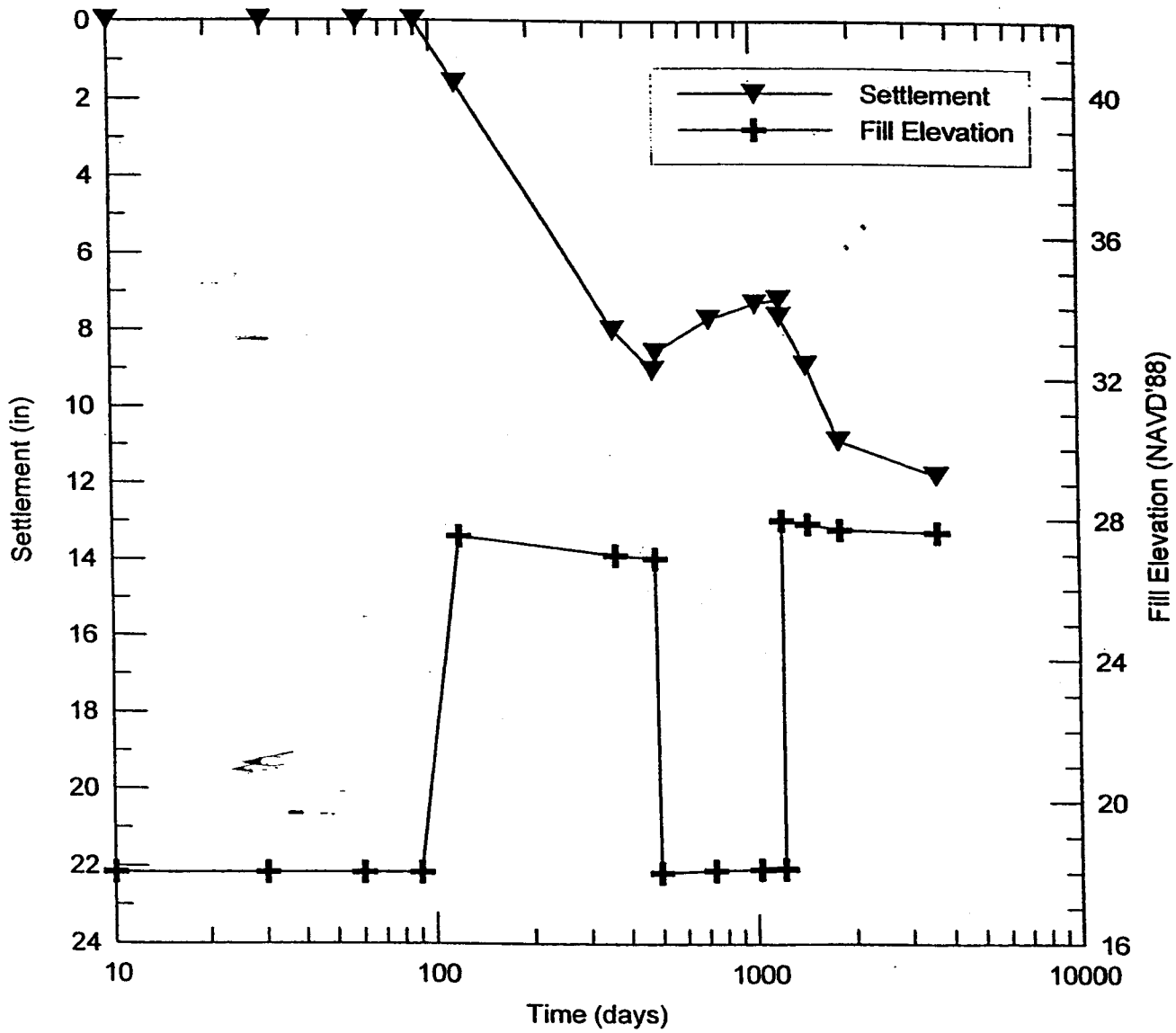
TIME-SETTLEMENT CURVES

1-yr Surcharge Period, 7-ft Wick Spacing
2-in. Post Construction Settlement Criteria



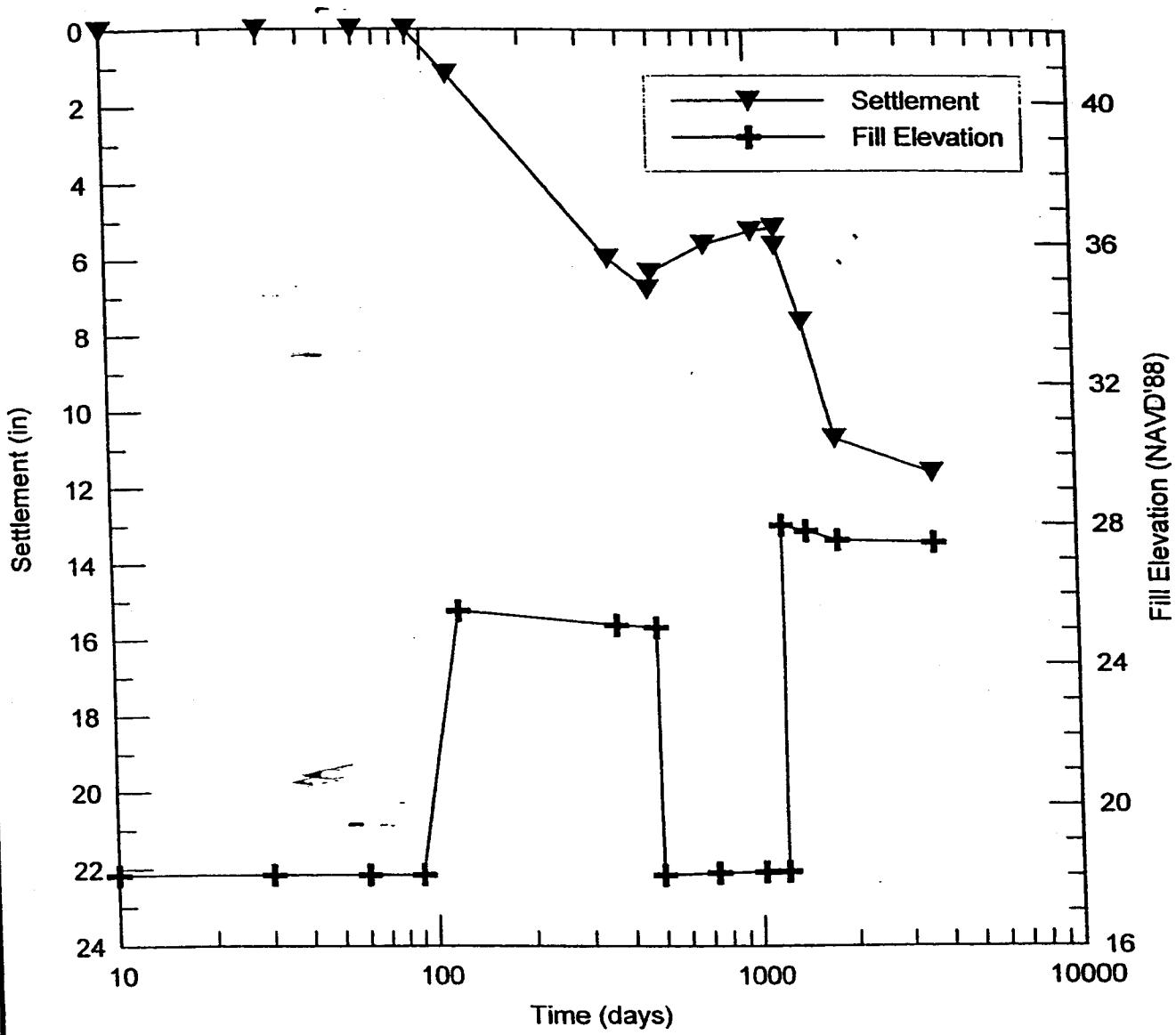
Job No : 1131-99-588	S&ME	**Settlement Results** Container Yard – Cell C Proposed Shoal Point Terminal Texas City, Texas	Figure No: A-3
Date: November 10, 1999			
Not to Scale			

1-yr Surcharge Period, 7-ft Wick Spacing
3-in. Post Construction Settlement Criteria



Job No : 1131-99-588	S&ME	**Settlement Results** Container Yard – Cell C Proposed Shoal Point Terminal Texas City, Texas	Figure No:
Date: November 10, 1999			A-4
Not to Scale			

1-yr Surcharge Period, 7-ft Wick Spacing
5-in. Post Construction Settlement Criteria



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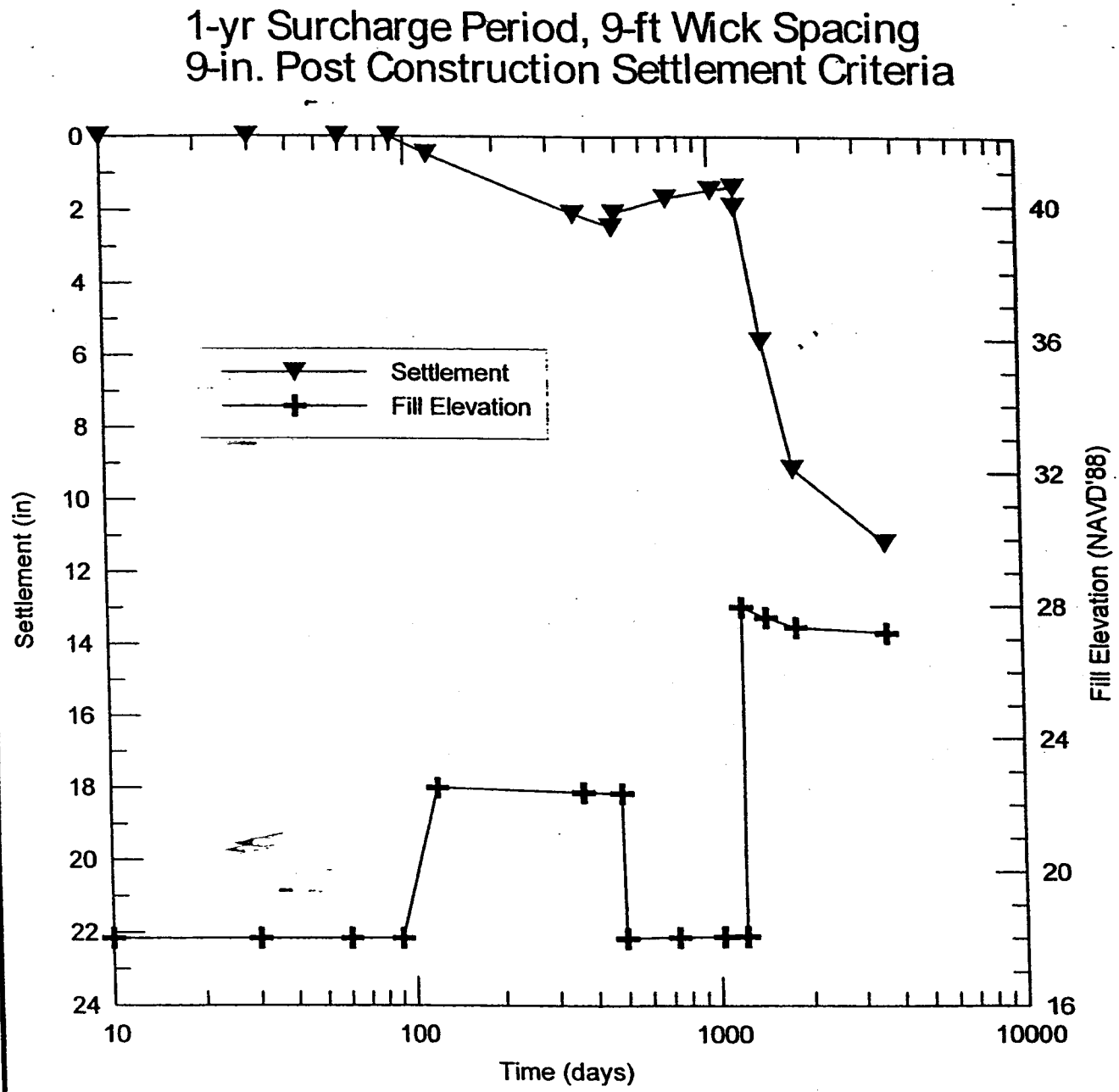
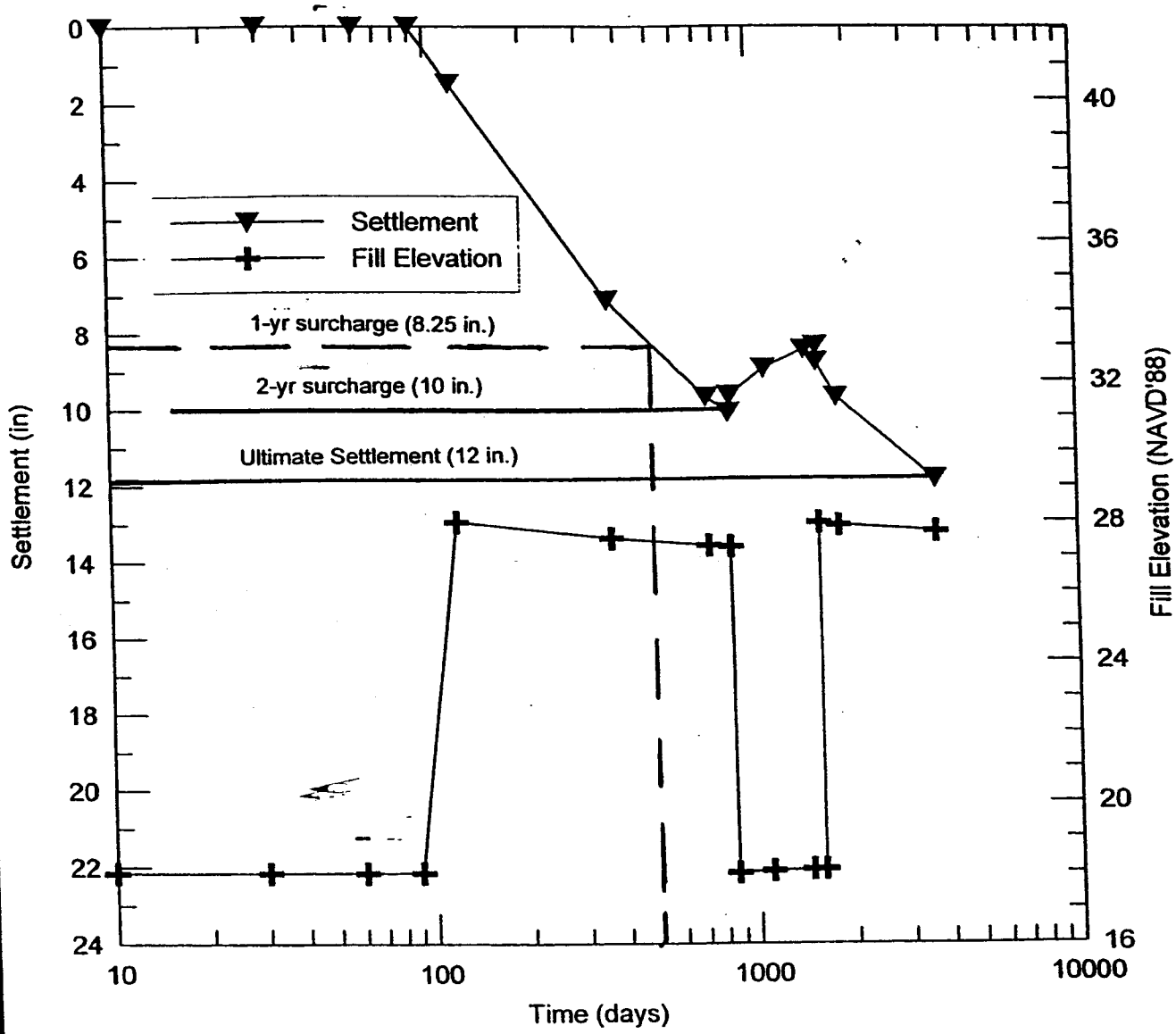
Date: November 10, 1999			
Not to Scale			



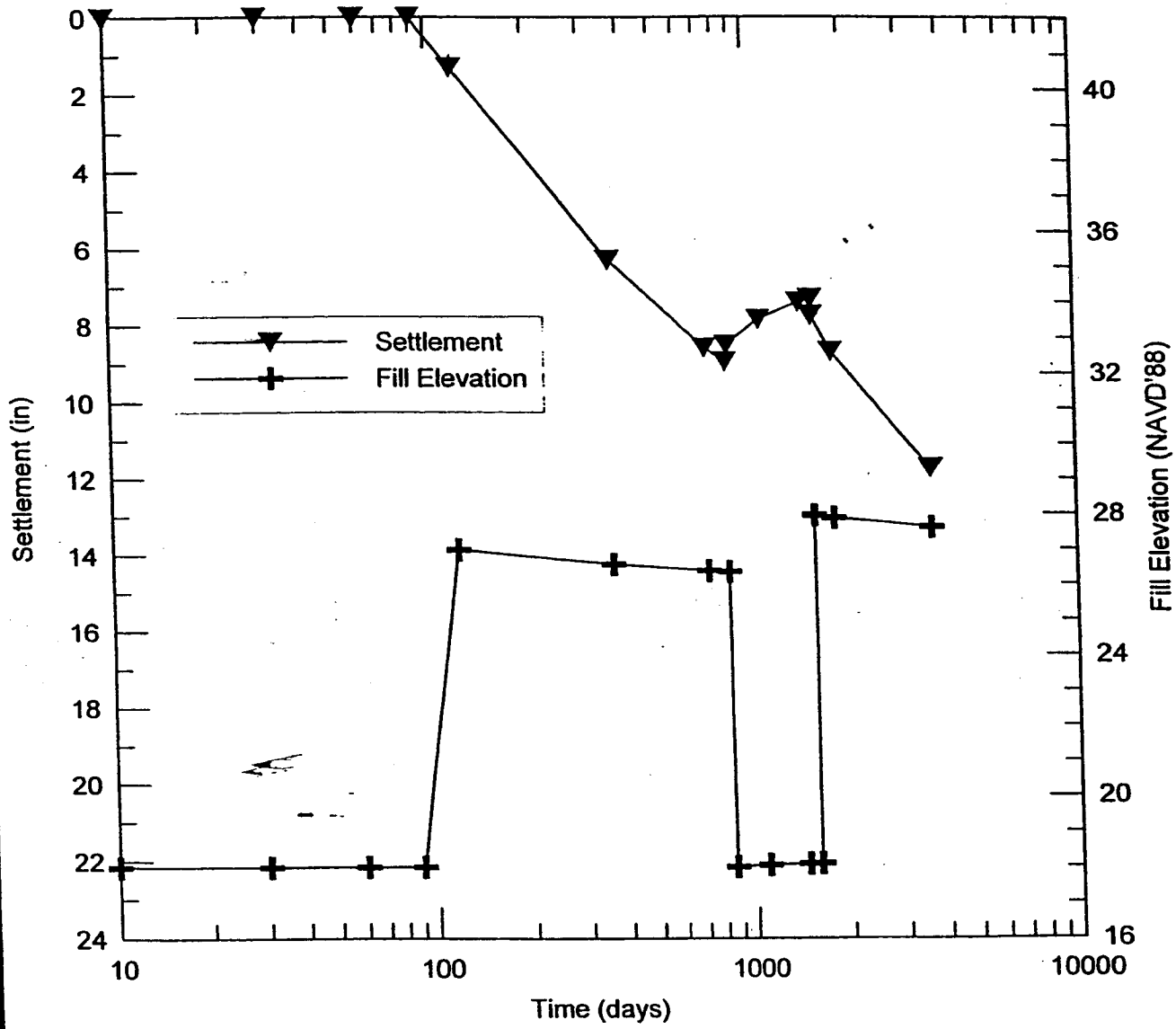
Job No : 1131-99-588	S&ME	**Settlement Results** Container Yard – Cell C Proposed Shoal Point Terminal Texas City, Texas	Figure No:
Date: November 10, 1999			A-6
Not to Scale			

2-yr Surcharge Period, 9-ft Wick Spacing
2-in. Post Construction Settlement Criteria

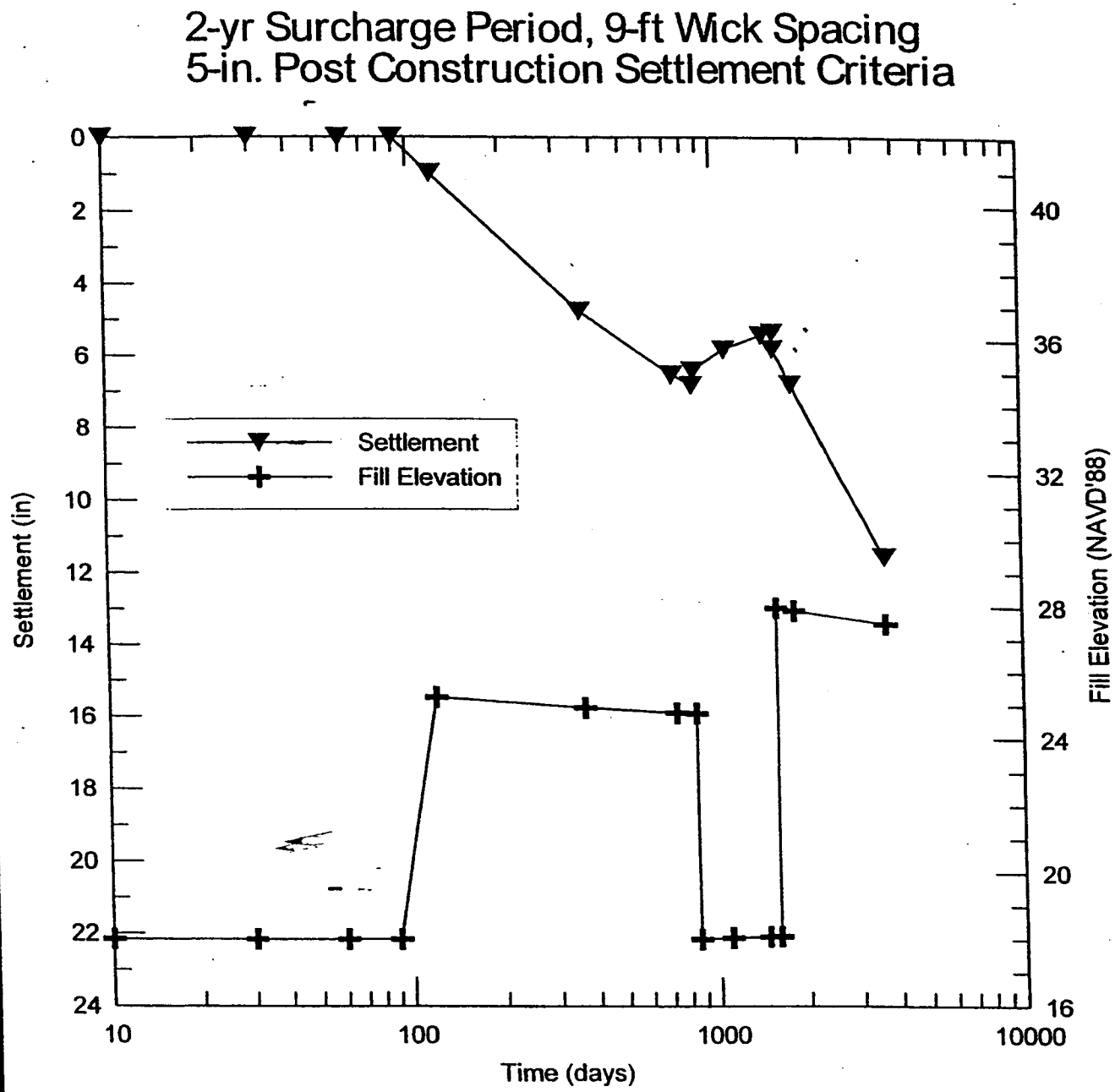


Job No : 1131-99-588	S&ME	**Settlement Results** Container Yard – Cell C Proposed Shoal Point Terminal Texas City, Texas	Figure No: A-7
Date: November 10, 1999			
Not to Scale			

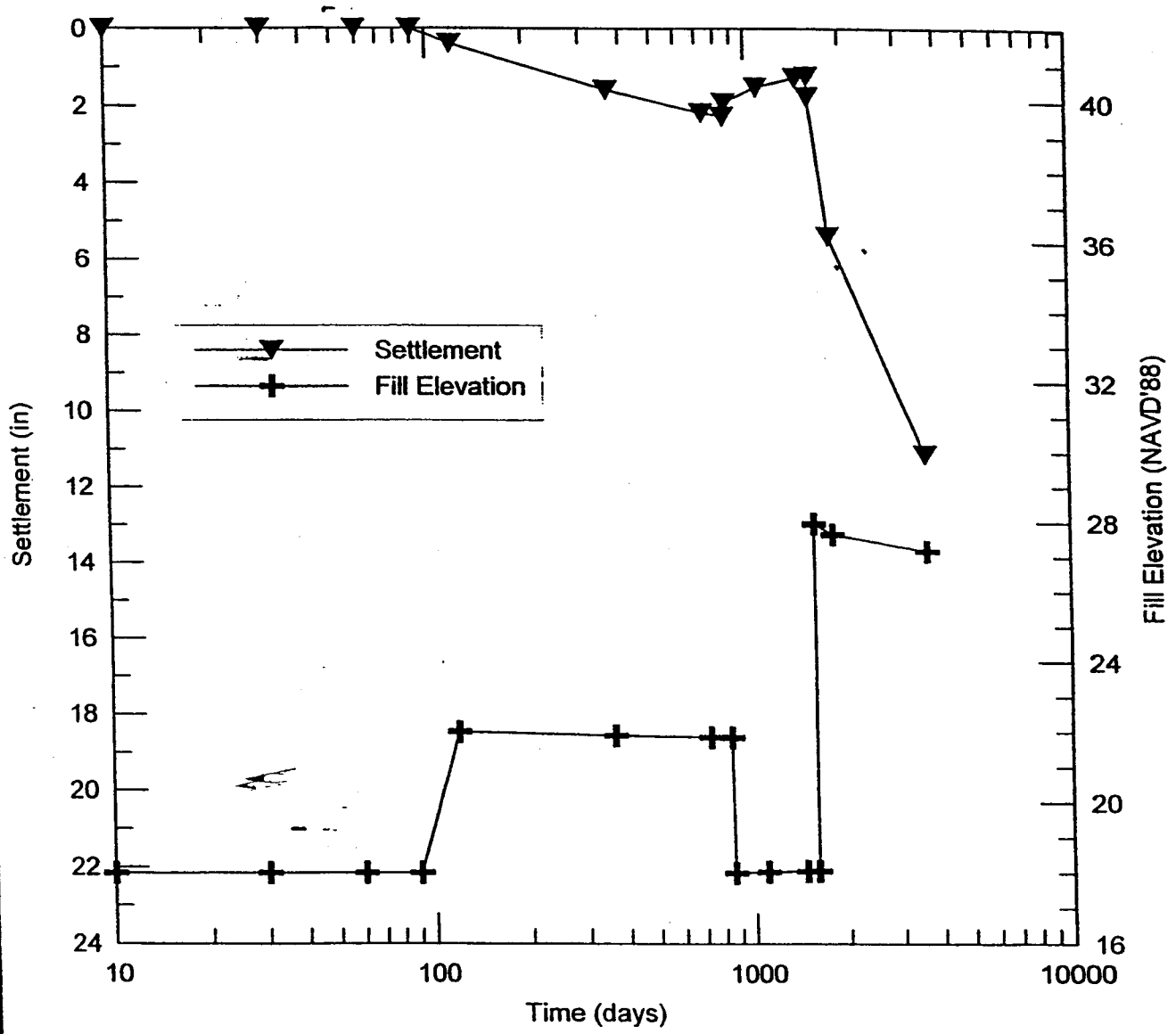
2-yr Surcharge Period, 9-ft Wick Spacing
3-in. Post Construction Settlement Criteria



Job No : 1131-99-588	S&ME	**Settlement Results** Container Yard – Cell C Proposed Shoal Point Terminal Texas City, Texas	Figure No: A-8
Date: November 10, 1999			
Not to Scale			



Job No : 1131-99-588	S&ME	**Settlement Results** Container Yard – Cell C Proposed Shoal Point Terminal Texas City, Texas	Figure No:
Date: November 10, 1999			A-9
Not to Scale			

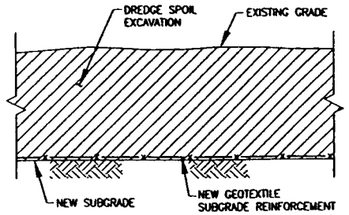


Job No : 1131-99-588	S&ME	**Settlement Results** Container Yard – Cell C Proposed Shoal Point Terminal Texas City, Texas	Figure No:
Date: November 10, 1999			A-10
Not to Scale			

EXHIBIT 2

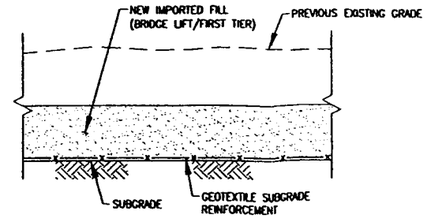
Option A Construction Sequence and Costs

- Typical Site Sections
- Assumptions
- Input
- Costs
- Summary



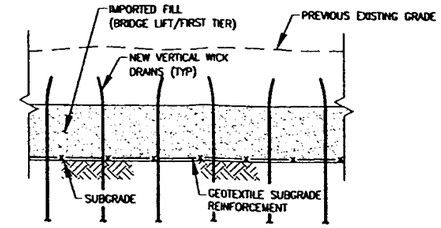
SEQUENCE No. 1 TYPICAL SECTION

- ON-SITE EXCAVATION/LOADING (SPOIL)
- ON-SITE STOCKPILING/DISPOSAL (SPOIL)
- GEOTEXTILE SUBGRADE REINFORCEMENT



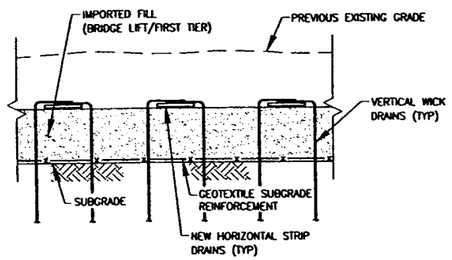
SEQUENCE No. 2 TYPICAL SECTION

- IMPORTED FILL DELIVERED (BRIDGE LIFT/FIRST TIER)
- FILL GRADING/COMPACTION (BRIDGE LIFT/FIRST TIER)



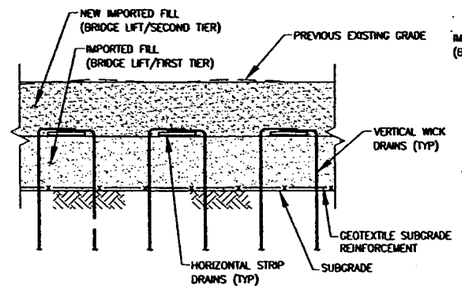
SEQUENCE No. 3 TYPICAL SECTION

- VERTICAL WICK DRAINS (MATERIAL/INSTALLATION)



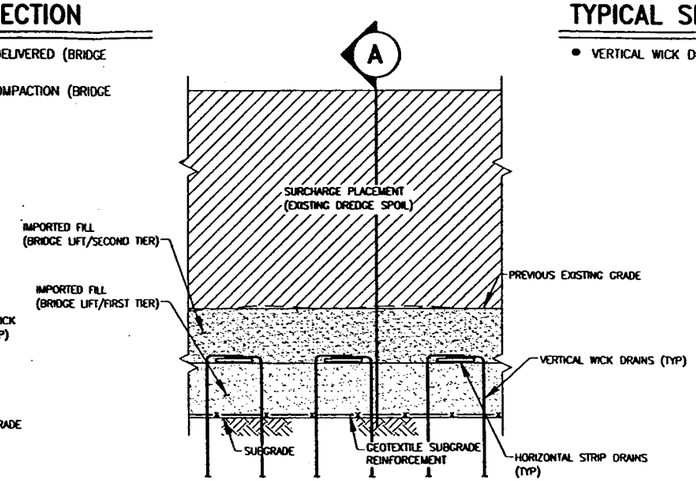
SEQUENCE No. 4 TYPICAL SECTION

- HORIZONTAL STRIP DRAINS (MATERIAL/INSTALLATION)



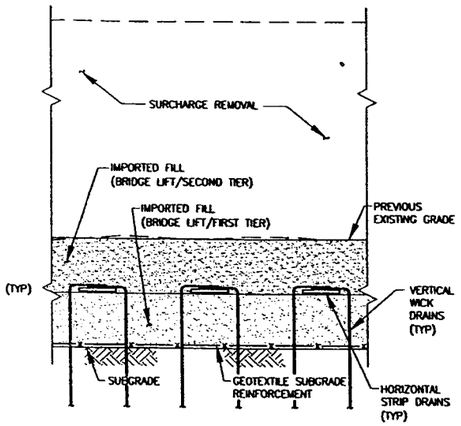
SEQUENCE No. 5 TYPICAL SECTION

- IMPORTED FILL DELIVERED (BRIDGE LIFT/SECOND TIER)
- FILL GRADING/COMPACTION (BRIDGE LIFT/SECOND TIER)



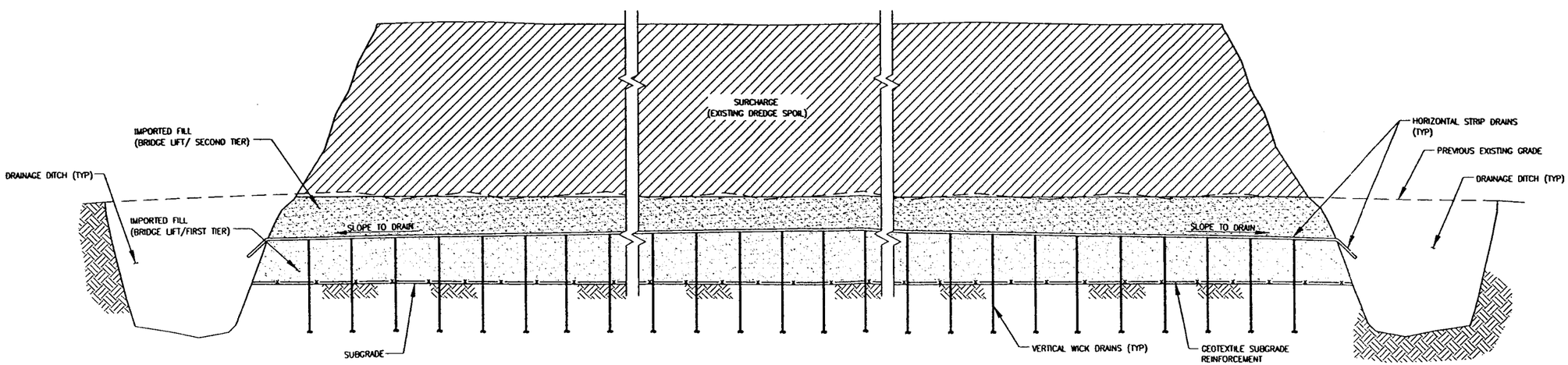
SEQUENCE No. 6 TYPICAL SECTION

- ON-SITE EXCAVATION/LOADING (SPOIL/SURCHARGE)
- ON-SITE BACKFILLING/GRADING (SURCHARGE)



SEQUENCE No. 7 TYPICAL SECTION

- ON-SITE EXCAVATION/LOADING (SURCHARGE REMOVAL)



TYPICAL SECTION "A"

PRELIMINARY
THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.
ENGINEER: GERALD J. HAUSKE, JR.
REGISTRATION No.: 80479
DATE: 12/27/99

REV	DATE	DESCRIPTION	APP

PWT 01/00
NONE
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90197

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

OPTION A CONSTRUCTION SEQUENCE

TYPICAL SITE SECTIONS

EXHIBIT II

90197a01.dwg 11900 11218

Option A

Assumptions

Construction Stages	3
Post-Construction Settlement	5 to 9 Inches (Approx. 7 Inches)
Consolidation Time	1 to 2 Years/Stage
Overall Development Time	Unrestricted
Stage One, Two & Three Bridge Lift	Imported Fill (2 Tiers)
Top of Total Bridge Lift	Pavement Section Subgrade Elevation
Stage One, Two & Three Surcharge	On-Site Spoil Material

Input

Horizontal Parameters	
Total Terminal	210 ac.
Stage One	70 ac.
Stage Two	70 ac.
Stage Three	70 ac.
Wick Drain Spacing	9 ft.

Vertical Parameters	
Average Existing Grade Elevation	20 ft.
Pavement Section Subgrade Elevation	18 ft.
Wick Drain Top Elevation	16.5 ft.
Wick Drain Bottom Elevation	-16 ft.
Surcharge Height	6 ft.
Bridge Lift Fill Depth (First Tier)	1.5 ft.
Bridge Lift Fill Depth (Second Tier)	1.5 ft.

Imported Fill Parameters	
Fill Purchase Price	$1.50/CY
Loading Price	$0.50/CY
Transportation Price	$45.00/hr.
Transportation Distance (1-way)	10 mi.
Average Transportation Speed	30 MPH
Loading Time	10 min.
Load Size	15 CY
Total Imported Fill Price	$4.50/CY

Unit Costs	
Imported Fill Delivered	$4.50/CY
On-Site Excavation/Loading	$1.25/CY
On-Site Stockpiling/Disposal	$0.50/CY
On-Site Backfilling/Grading	$0.50/CY
Vertical Wick Drains	$0.50/LF
Horizontal Strip Drains	$1.00/LF
Geotextile Subgrade Reinforcement	$1.50/SY
Fill Grading/Compaction:	$0.75/CY

Costs

Seq.	Stage One Site Preparation	Quantity	Unit	Unit Price	Extended Price
1	On-Site Excavation/Loading (Spoil)	564,667	CY	$ 1.25	$ 705,833
1	On-Site Stockpiling/Disposal (Spoil)	564,667	CY	0.50	282,333
1	Geotextile Subgrade Reinforcement	338,800	SY	1.50	508,200
2	Imported Fill Delivered (Bridge Lift/First Tier)	169,400	CY	4.50	762,300
2	Fill Grading/Compaction (Bridge Lift/First Tier)	169,400	CY	0.75	127,050
3	Vertical Wick Drains (Material/Installation)	1,412,753	LF	0.50	706,377
4	Horizontal Strip Drains (Material/Installation)	195,612	LF	1.00	195,612
5	Imported Fill Delivered (Bridge Lift/Second Tier)	169,400	CY	4.50	762,300
5	Fill Grading/Compaction (Bridge Lift/Second Tier)	169,400	CY	0.75	127,050
6	On-Site Excavation/Loading (Spoil/Surcharge)	677,600	CY	1.25	847,000
6	On-Site Backfilling/Grading (Surcharge)	677,600	CY	0.50	338,800
7	On-Site Excavation/Loading (Surcharge Removal)	677,600	CY	1.25	847,000
				Total Stage One Cost	**$ 6,209,855**

Seq.	Stage Two Site Preparation	Quantity	Unit	Unit Price	Extended Price
1	On-Site Excavation/Loading (Spoil)	564,667	CY	$ 1.25	$ 705,833
1	On-Site Stockpiling/Disposal (Spoil)	564,667	CY	0.50	282,333
1	Geotextile Subgrade Reinforcement	338,800	SY	1.50	508,200
2	Imported Fill Delivered (Bridge Lift/First Tier)	169,400	CY	4.50	762,300
2	Fill Grading/Compaction (Bridge Lift/First Tier)	169,400	CY	0.75	127,050
3	Vertical Wick Drains (Material/Installation)	1,412,753	LF	0.50	706,377
4	Horizontal Strip Drains (Material/Installation)	195,612	LF	1.00	195,612
5	Imported Fill Delivered (Bridge Lift/Second Tier)	169,400	CY	4.50	762,300
5	Fill Grading/Compaction (Bridge Lift/Second Tier)	169,400	CY	0.75	127,050
6	On-Site Excavation/Loading (Spoil/Surcharge)	677,600	CY	1.25	847,000
6	On-Site Backfilling/Grading (Surcharge)	677,600	CY	0.50	338,800
7	On-Site Excavation/Loading (Surcharge Removal)	677,600	CY	1.25	847,000
				Total Stage Two Cost	**$ 6,209,855**

Seq.	Stage Three Site Preparation	Quantity	Unit	Unit Price	Extended Price
1	On-Site Excavation/Loading (Spoil)	564,667	CY	$ 1.25	$ 705,833
1	On-Site Stockpiling/Disposal (Spoil)	564,667	CY	0.50	282,333
1	Geotextile Subgrade Reinforcement	338,800	SY	1.50	508,200
2	Imported Fill Delivered (Bridge Lift/First Tier)	169,400	CY	4.50	762,300
2	Fill Grading/Compaction (Bridge Lift/First Tier)	169,400	CY	0.75	127,050
3	Vertical Wick Drains (Material/Installation)	1,412,753	LF	0.50	706,377
4	Horizontal Strip Drains (Material/Installation)	195,612	LF	1.00	195,612
5	Imported Fill Delivered (Bridge Lift/Second Tier)	169,400	CY	4.50	762,300
5	Fill Grading/Compaction (Bridge Lift/Second Tier)	169,400	CY	0.75	127,050
6	On-Site Excavation/Loading (Spoil/Surcharge)	677,600	CY	1.25	847,000
6	On-Site Backfilling/Grading (Surcharge)	677,600	CY	0.50	338,800
7	On-Site Excavation/Loading (Surcharge Removal)	677,600	CY	1.25	847,000
7	On-Site Stockpiling/Disposal (Spoil)	677,600	CY	0.50	338,800
				Total Stage Three Cost	**$ 6,548,655**

Summary

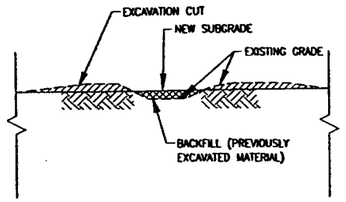
Stage One Costs	$ 6,209,855
Stage Two Costs	6,209,855
Stage Three Costs	6,548,655
Total Terminal Cost	**$ 18,968,365**

Stage One Costs/Acre	$ 88,712
Stage Two Costs/Acre	88,712
Stage Three Costs/Acre	93,552
Total Terminal Cost/Acre	**$ 90,325**

EXHIBIT 3

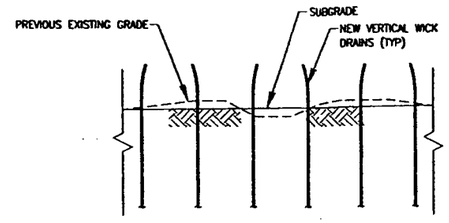
Option B Construction Sequence and Costs

- Typical Site Sections
- Assumptions
- Input
- Costs
- Summary



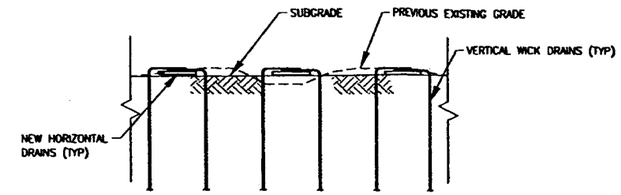
SEQUENCE No. 1 TYPICAL SECTION

- ON-SITE EXCAVATION/LOADING (SPOIL)
- ON-SITE STOCKPILING/DISPOSAL (SPOIL)



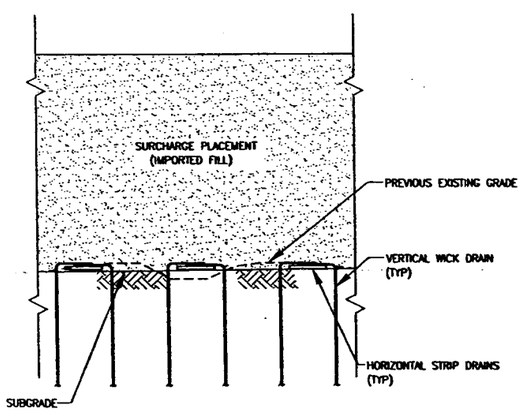
SEQUENCE No. 2 TYPICAL SECTION

- VERTICAL WICK DRAINS (MATERIAL/INSTALLATION)



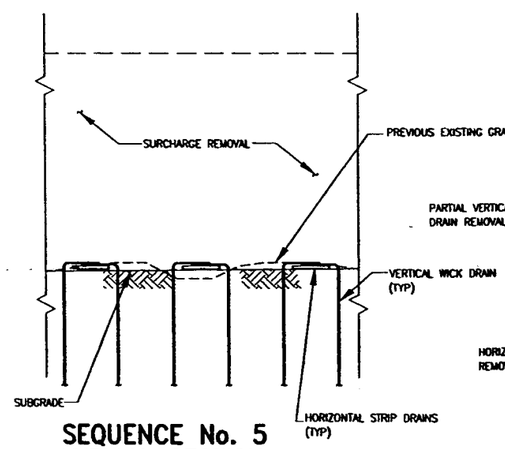
SEQUENCE No. 3 TYPICAL SECTION

- HORIZONTAL STRIP DRAINS (MATERIAL/INSTALLATION)



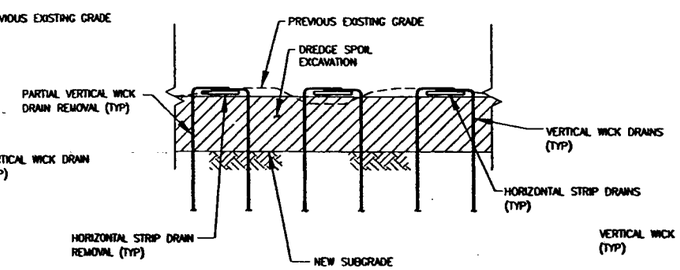
SEQUENCE No. 4 TYPICAL SECTION

- IMPORTED FILL DELIVERED (SURCHARGE)
- ON-SITE BACKFILLING/GRADING (SURCHARGE)

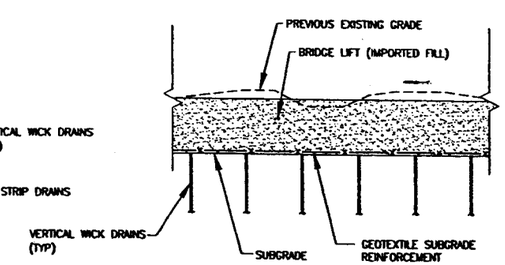


SEQUENCE No. 5 TYPICAL SECTION

- ON-SITE EXCAVATION/LOADING (SURCHARGE REMOVAL)



SEQUENCE No. 6 TYPICAL SECTION



SEQUENCE No. 7 TYPICAL SECTION

NOTE:

SEQUENCE NOS. 6 AND 7 ARE NOT INCLUDED IN COSTS. IT IS ASSUMED THAT THESE ACTIVITIES WILL BE CONCURRENT WITH FUTURE TERMINAL DEVELOPEMENT ACTIVITIES.

PRELIMINARY

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.

ENGINEER: GERALD J. HAUSKE, JR.
REGISTRATION No.: 80479
DATE: 12/27/99

REV	DATE	DESCRIPTION	APP

PMT 01/00
NONE
90197e01.dwg
90197

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

OPTION B
CONSTRUCTION SEQUENCE

TYPICAL SITE SECTIONS

EXHIBIT III

90197e01.dwg 11900 11218

Option B

Assumptions

Construction Stages	3
Post-Construction Settlement	5 to 9 Inches (Approx. 7 Inches)
Consolidation Time	1 to 2 Years/Stage
Overall Development Time	Unrestricted
Stage One Surcharge	Imported Fill
Stage Two & Three Surcharge	Previous Surcharge
Stage Three Surcharge Removal	Surplus at End of Activity
Geotextile Subgrade Reinforcement	Not Included
Bridge Lift Construction	Not Included

Input

Horizontal Parameters	
Total Terminal	210 ac.
Stage One	70 ac.
Stage Two	70 ac.
Stage Three	70 ac.
Wick Drain Spacing	9 ft.

Vertical Parameters	
Average Existing Grade Elevation	20 ft.
Pavement Section Subgrade Elevation	18 ft.
Wick Drain Top Elevation	18 ft.
Wick Drain Bottom Elevation	-16 ft.
Surcharge Height	6 ft.
Bridge Lift Fill Depth (First Tier)	3 ft.

Imported Fill Parameters	
Fill Purchase Price	$1.50/CY
Loading Price	$0.50/CY
Transportation Price	$45.00/hr.
Transportation Distance (1-way)	10 mi.
Average Transportation Speed	30 MPH
Loading Time	10 min.
Load Size	15 CY
Total Imported Fill Price	$4.50/CY

Unit Costs	
Imported Fill Delivered	$4.50/CY
On-Site Excavation/Loading	$1.25/CY
On-Site Stockpiling/Disposal	$0.50/CY
On-Site Backfilling/Grading	$0.50/CY
Vertical Wick Drains	$0.50/LF
Horizontal Strip Drains	$1.00/LF
Geotextile Subgrade Reinforcement	$1.50/SY
Fill Grading/Compaction:	$0.75/CY

Costs

Seq.	Stage One Site Preparation	Quantity	Unit	Unit Price	Extended Price
1	On-Site Excavation/Loading (Spoil)	225,867	CY	$ 1.25	$ 282,333
1	On-Site Stockpiling/Disposal (Spoil)	225,867	CY	0.50	112,933
2	Vertical Wick Drains (Material/Installation)	1,477,957	LF	0.50	738,978
3	Horizontal Strip Drains (Material/Installation)	195,612	LF	1.00	195,612
4	Imported Fill Delivered (Surcharge)	677,600	CY	4.50	3,049,200
4	On-Site Backfilling/Grading (Surcharge)	677,600	CY	0.50	338,800
5	On-Site Excavation/Loading (Surcharge Removal)	677,600	CY	1.25	847,000
	Total Stage One Cost				**$ 5,564,856**

Seq.	Stage Two Site Preparation	Quantity	Unit	Unit Price	Extended Price
1	On-Site Excavation/Loading (Spoil)	225,867	CY	$ 1.25	$ 282,333
1	On-Site Stockpiling/Disposal (Spoil)	225,867	CY	0.50	112,933
2	Vertical Wick Drains (Material/Installation)	1,477,957	LF	0.50	738,978
3	Horizontal Strip Drains (Material/Installation)	195,612	LF	1.00	195,612
4	On-Site Backfilling/Grading (Surcharge)	677,600	CY	0.50	338,800
5	On-Site Excavation/Loading (Surcharge Removal)	677,600	CY	1.25	847,000
	Total Stage Two Cost				**$ 2,515,656**

Seq.	Stage Three Site Preparation	Quantity	Unit	Unit Price	Extended Price
1	On-Site Excavation/Loading (Spoil)	225,867	CY	$ 1.25	$ 282,333
1	On-Site Stockpiling/Disposal (Spoil)	225,867	CY	0.50	112,933
2	Vertical Wick Drains (Material/Installation)	1,477,957	LF	0.50	738,978
3	Horizontal Strip Drains (Material/Installation)	195,612	LF	1.00	195,612
4	On-Site Backfilling/Grading (Surcharge)	677,600	CY	0.50	338,800
5	On-Site Excavation/Loading (Surcharge Removal)	677,600	CY	1.25	847,000
5	On-Site Stockpiling/Disposal (Surcharge Surplus)	677,600	CY	0.50	338,800
	Total Stage Three Cost				**$ 2,854,456**

Summary

Stage One Costs	$ 5,564,856
Stage Two Costs	2,515,656
Stage Three Costs	2,854,456
Total Terminal Cost	**$ 10,934,968**

Stage One Costs/Acre	$ 79,497
Stage Two Costs/Acre	35,937
Stage Three Costs/Acre	40,777
Total Terminal Cost/Acre	**$ 52,070**

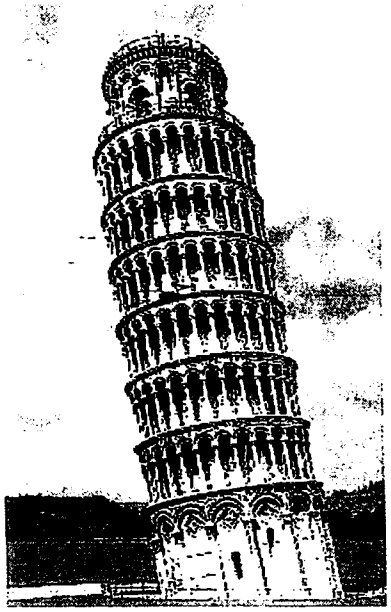
EXHIBIT 4

General Information on Wick Drain Installations (Manufacturer/Installer Literature)

- Soil Consolidation with Amerdrain® Vertical Drains
- Installing Amerdrain® Vertical Drains
- Akwadrain™ Horizontal Strip Drains for Vertical Drain Installation

AMERICAN WICK DRAIN CORPORATION

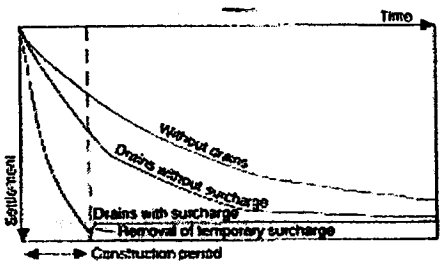
Soil consolidation with AMERDRAIN® prefabricated vertical drains



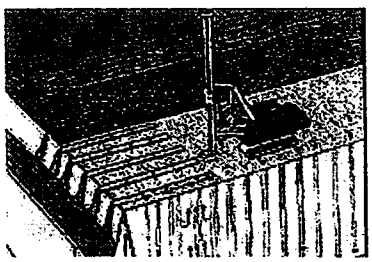
The problem

Historically, the design of structures on soft compressible soils (clays) has created problems for civil engineers. Construction without some sort of soil treatment is usually impractical due to unpredictable long-term settlement. Simple surcharging as a soil consolidation method can take many years. Although surcharging increases water pore pressure, settlement can take considerable time, as the water lacks easy path to leave the soil.

The solution



Soil consolidation using prefabricated vertical drains (also commonly called wick drains or band drains) can reduce settlement times from years to months. Most settlement can occur during construction, thus keeping post-construction settlements to a minimum.

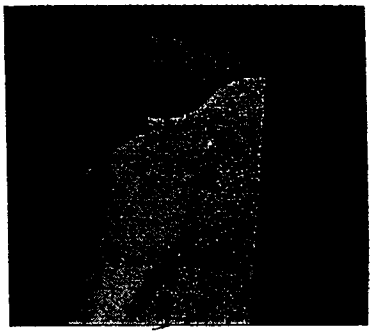


Consolidation of water-saturated, fine-grained soil occurs very slowly because the low permeability of these soils impedes the escape of pore water from the soil voids. Even under large temporary surcharge loads, settlements can take years because of this slow water movement and the great distance the water must move to exit the soil. The installation of prefabricated vertical drains

greatly reduces the distance the water must move to reach a free drainage path, and therefore greatly increases settlement rate. Drain spacing may be adjusted to match the required settlement time.

Typical vertical drain installation

AMERDRAIN prefabricated drains are installed vertically to depths exceeding 200 feet (65 meters). The water, under pressure in excess of hydrostatic, flows through the filter fabric of the drain and into the channels of the drain core where it can flow vertically out of the soil. This flow may be either up or down to intersecting natural sand layers or to the surface where a sand drainage blanket or prefabricated strip drains are provided. The water in the soil has only to travel the distance to the nearest drain to reach a free drainage path. The drains are usually placed in a triangular configuration of 3 to 12 feet (1 to 4 meters) - depending on the desired consolidation time. As a result of this method of accelerating the consolidation process, uneven post-construction settlements can be virtually eliminated.


AMERDRAIN 407 vertical drain

AMERDRAIN vertical drain is installed in the following geographic areas:

- **United States** - all states except Arkansas
- **Western Hemisphere** - Argentina, Canada, Columbia, Mexico, Panama, Puerto Rico, West Indies
- **Europe** - Finland, The Netherlands, Italy
- **Middle East** - Egypt, Turkey
- **Asia** - Brunei, Hong Kong, Korea, Malaysia, Taiwan, Thailand

- **Vertical drain related subjects**
- **AMERDRAIN** vertical drain specifications
- Installing vertical drains
- Horizontal strip drains for vertical drain installations
- Suggested specifications for installation of vertical drains

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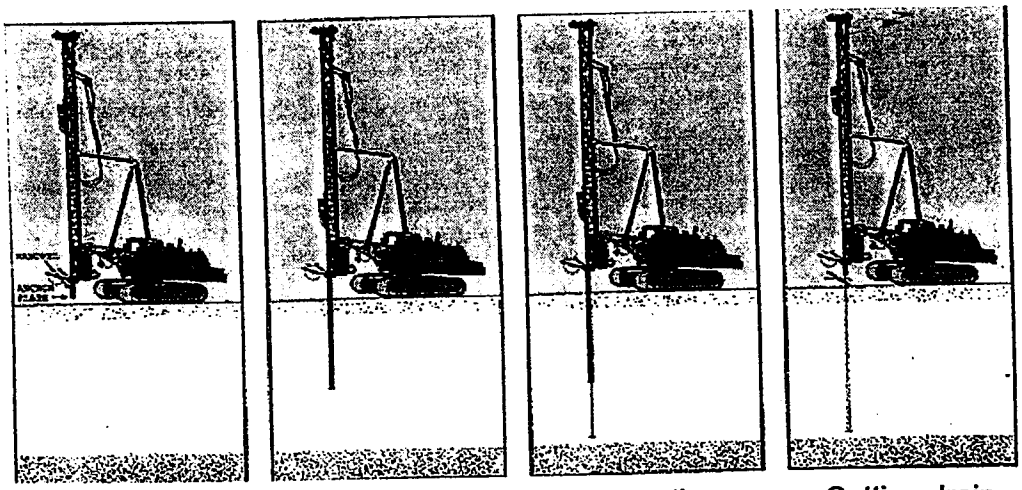
Contents | Contact us | Search | About AWD

AMERICAN WICK DRAIN CORPORATION

Installing AMERDRAIN® vertical drain

AMERDRAIN vertical drains may be installed employing either vibratory or static crowd methods. In either case, the drain is enclosed in a tubular steel mandrel of small cross-sectional area usually 2 x 5 inches(50 x 125mm). A small steel anchor plate is attached to the drain at the bottom of the mandrel. The mandrel is then driven in to the soil either with a static crowd or vibratory rig. When the design depth is reached, the mandrel is extracted. The anchor plate retains the drain in the soil. When the mandrel is fully extracted, the drain is cut off, a new anchor plate is installed and the process begins again.



Installation equipment | Driving mandrel | Extracting mandrel | Cutting drain

Related subjects

- Soil consolidation with vertical drains
- AMERDRAIN vertical drain specifications
- Horizontal strip drains for vertical drain installations
- Suggested specifications for installation of vertical drains

AKWADRAIN™ horizontal strip drains for vertical drain installation

Prior to the 1980's, most vertical drain installations were accomplished using a horizontal sand blanket for lateral drainage. This technique was reasonably effective, but sand blanket installation was slow and expensive. In addition, the sand was subject to clogging from silt infiltration from the surcharge.

Figure 1- Redwood City, California

In the late 1980's, larger prefabricated drains called "strip drains" were developed. These new drains were similar to prefabricated vertical drains but had higher flow capabilities and higher compressive strengths. In 1987, strip drains were used in conjunction with a sand blanket for horizontal drainage on a vertical drain soil consolidation job in Jacksonville, Florida. More recently, strip drains were used with a sand blanket on a job site in Massachusetts. However, more commonly, strip drains have been used alone (without any sand blanket) in vertical drain installations (Figures 1 & 2).

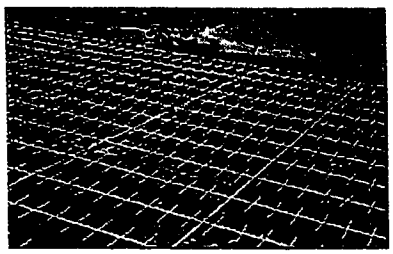


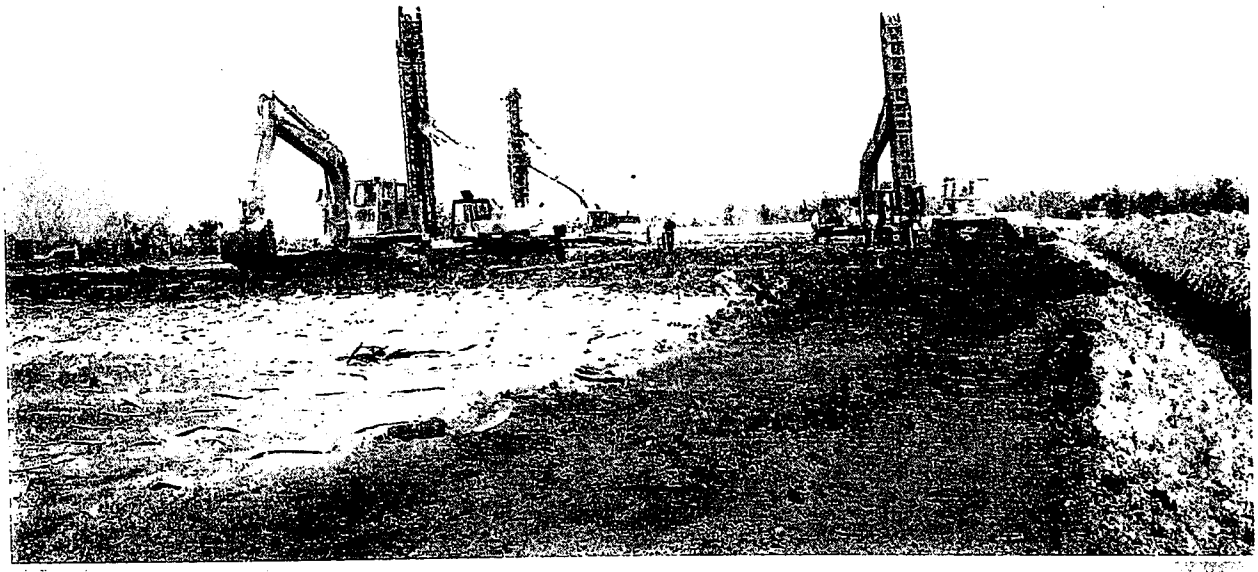
Figure 2- St. Peters, Mississippi

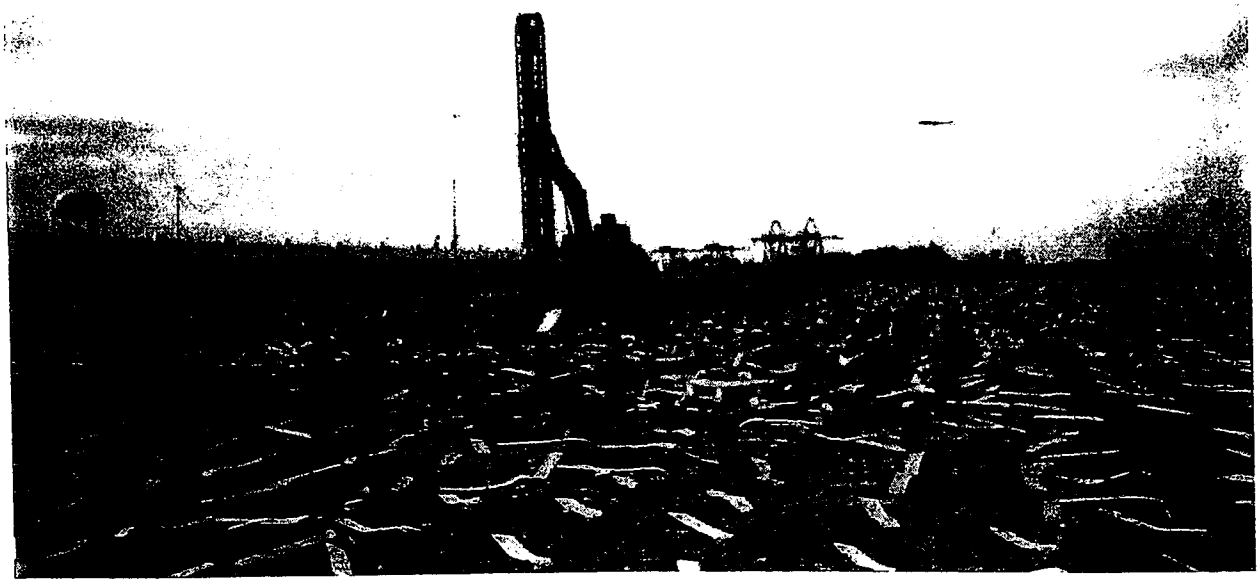
Strip drains offer three advantages over a sand blanket for providing lateral drainage. **First**, strip drains are less expensive. Material, freight and installation costs are usually lower for the prefabricated drains. **Second**, strip drains may be installed more quickly and with less manpower and equipment. And **third**, strip drains provide better drainage as their flow capacity is more predictable and less subject to clogging.

- **Related subjects**
- Consolidating soil with vertical drains
- Installing vertical drains
- AMERDRAIN® vertical drain specifications
- Suggested specifications for installation of vertical drains

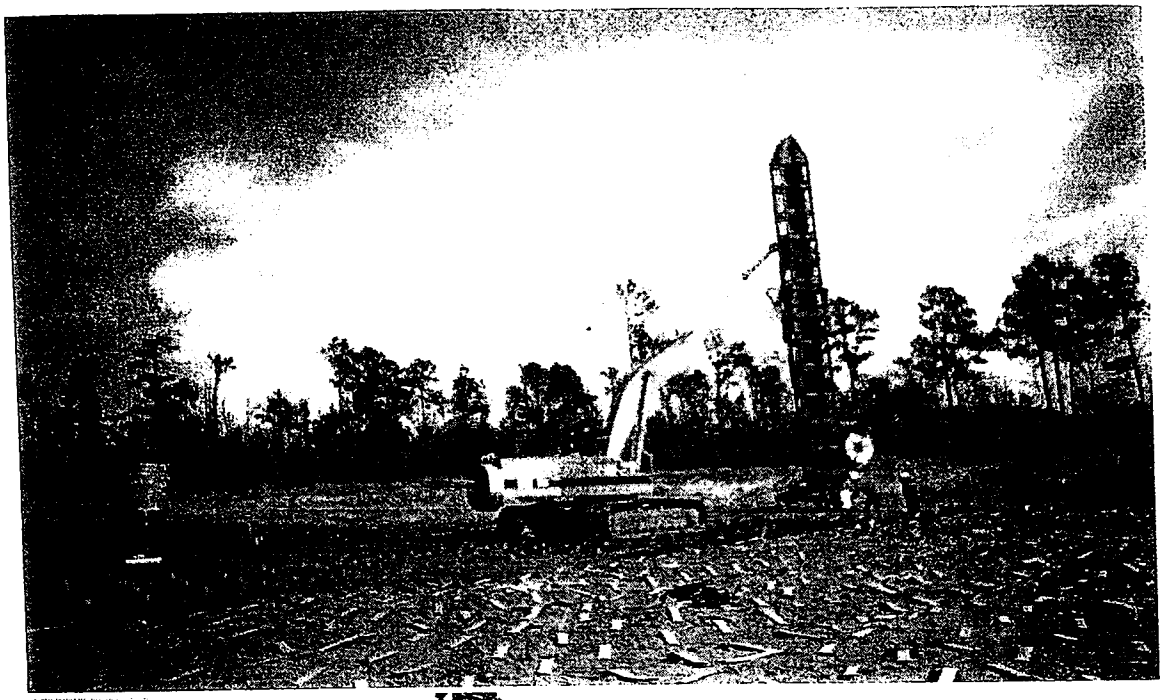
EXHIBIT 5

Miscellaneous Photographs of Actual Wick Drain Installation

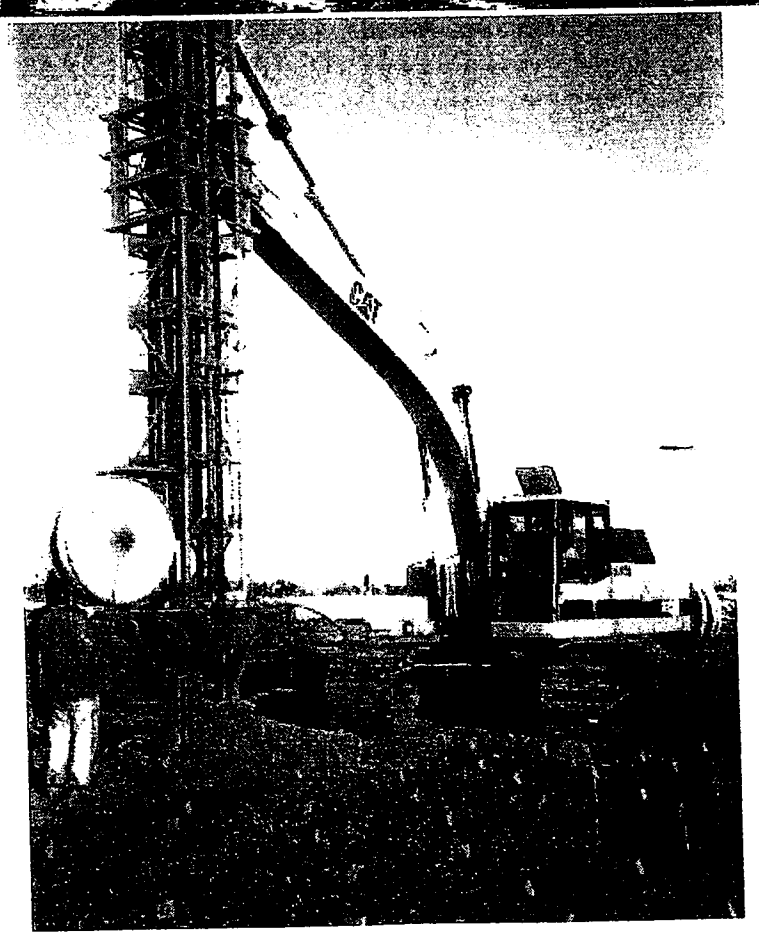




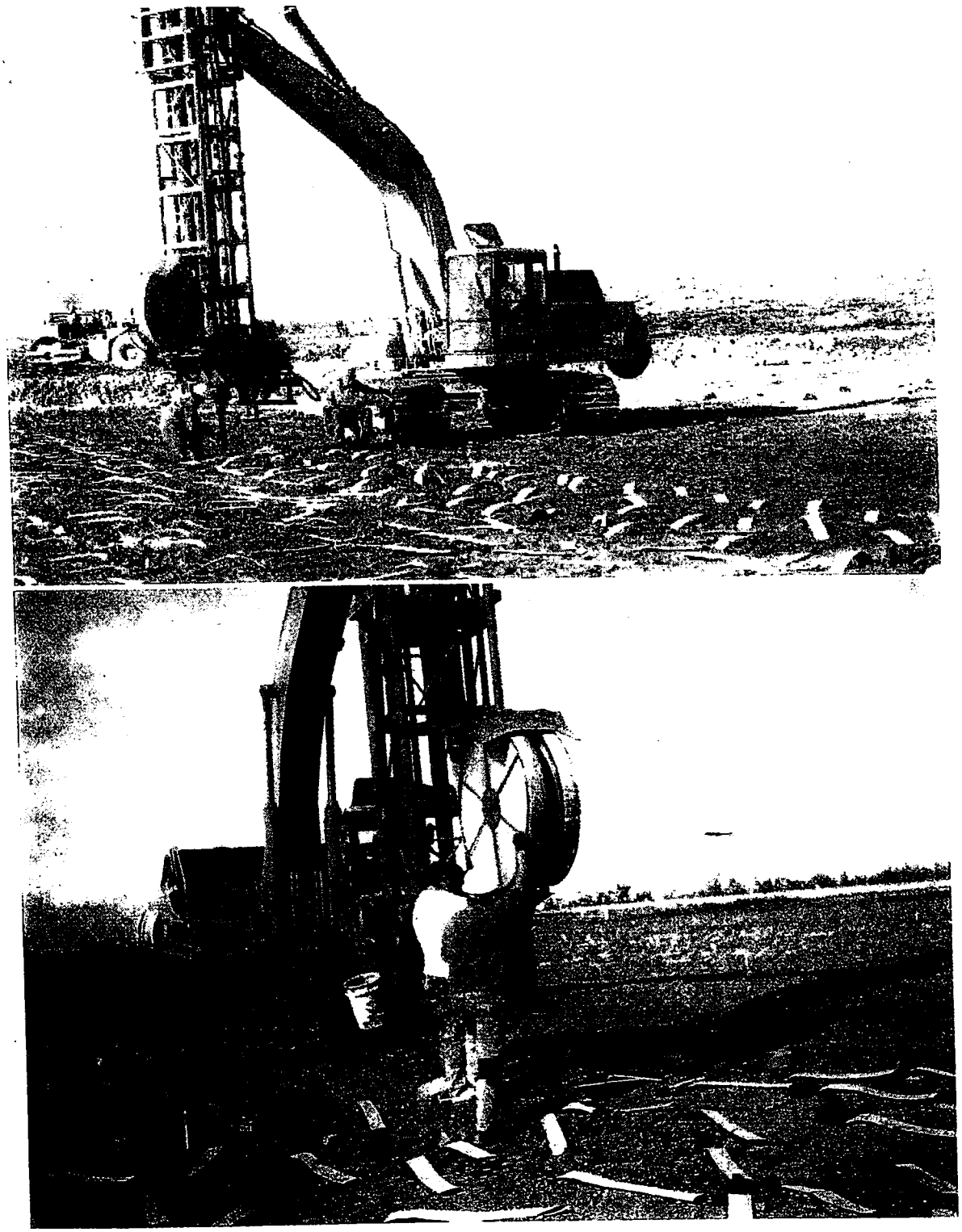
Vertical Wick Drain Installation



Vertical Wick Drain Installation



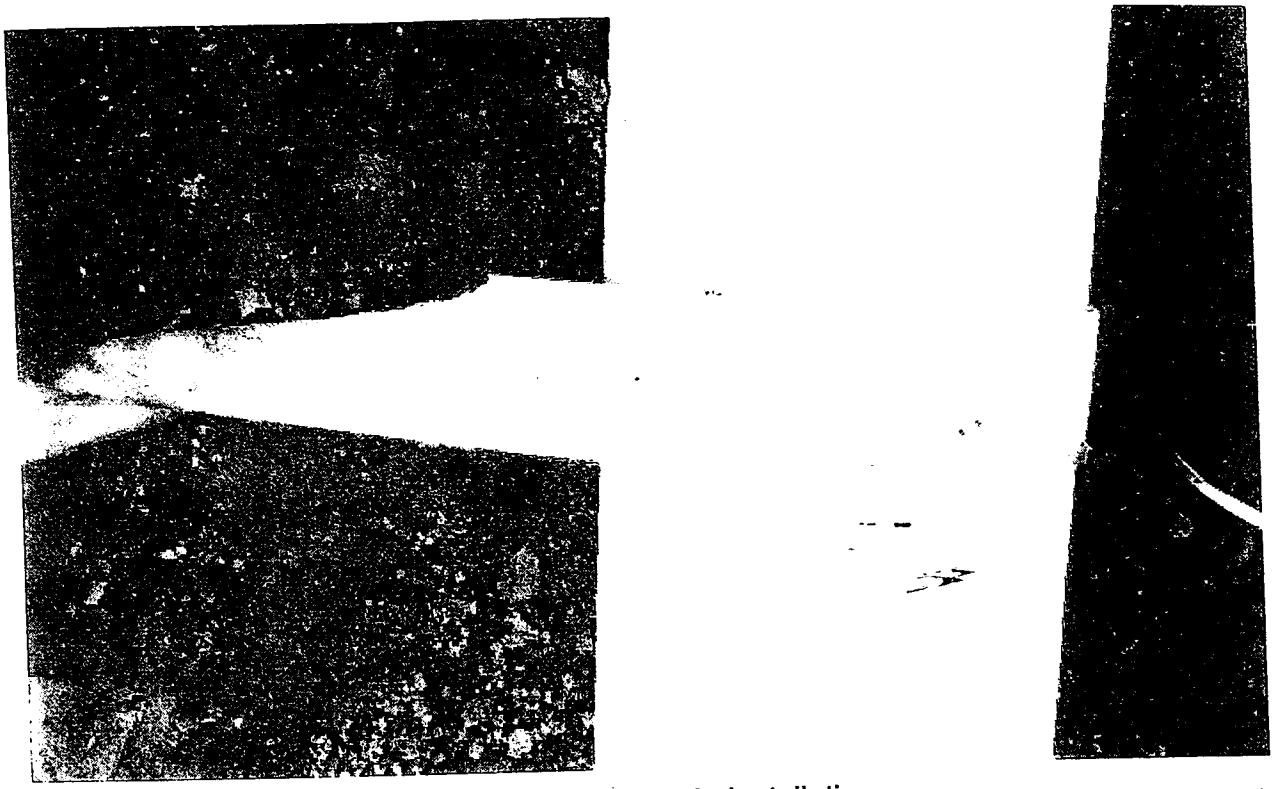
Vertical Wick Drain Installation



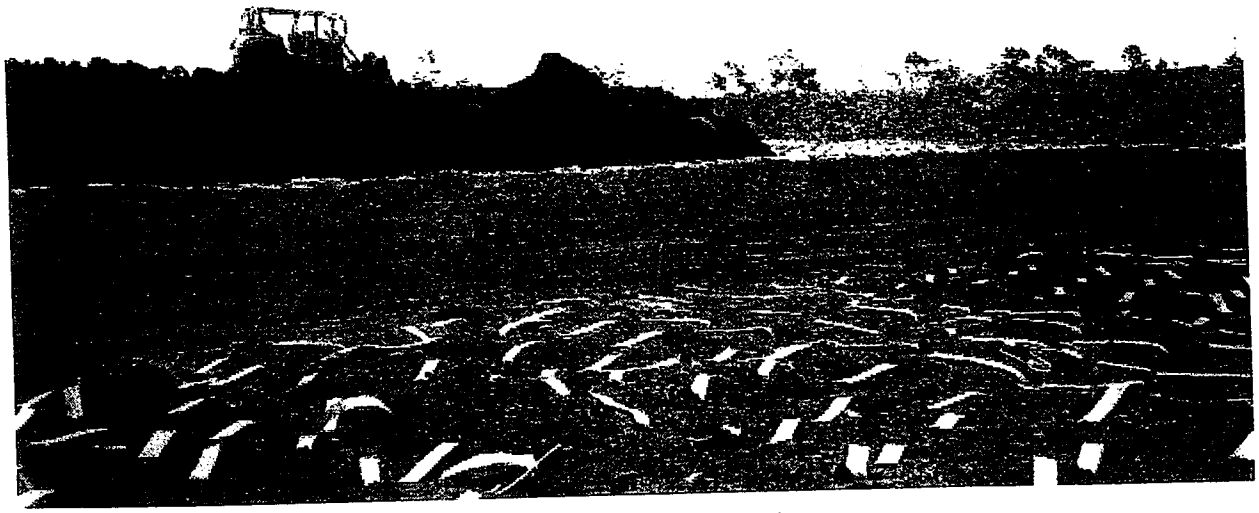
Vertical Wick Drain Installation

Vertical Wick Drain Installation

Horizontal Strip Drain Installation



Horizontal Strip Drain Installation



Surcharge Placement

May 1, 2002 XP11844

From the Desk of Alexine Strum

To:
Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U.S. Corp of Engineers
P.O. Box 1229
Galv., TX 77553-1229

Re: Port of Houston Proposed Expansion in Bayport

I sent a FAX opposing the Bayport Location months ago and since have attended meetings, listened and read all information including the most recent, and still feel it would destroy the environment, further polute the air and Galveston Bay and destroy the lifestyles of La Porte, Seabrook and the entire Bay Area. 29-106

Spillman Island or some other location would better serve Houston! 2-186

Sincerely,
Alexine Strum
606 Sandy Lane
Morgans Point, TX 77571

YP 11910

FAX: 409-766-3931

Mrs. Henry B. Kerr
110 Fairfield
Shoreacres, Tex. 77571
Sept. 5, 2002

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Sir:

You have received a letter from me before regarding the expansion of Bayport by the Port of Houston at a site immediately south of Shoreacres, LaPorte, and adjacent to Seabrook.

Thank you for sending me personally the public notice extending the comment period until today, Sept. 5, 2002.

Here's my comment on the Port's proposal – their Permit Application 21520 (Revised) –

From: Mrs. Henry B. Kerr - p.2

TO: Kerry M. Stanley - p.2
FAX: 409-766-3931

you sent me in this public notice a description of the Port's plans that distress me greatly: On some 1,000 plus acres (including 18 acres of ~~jurid~~ jurisdictional wetlands that exist within the project site) the Port would build CONTAINER STORAGE AREAS, — an intermodal yard — warehouse facilities, and properties available for light-industrial development — plus areas for docking, unloading and loading container ships as well as cruise ships.

22-178

Such activities at this site - Bayport - can kill the upper Galveston Bay communities' quality of life — the beauty of Texas coastal living, the staging area for national competition in boating and sailboat racing,

From: Mrs. Henry B. Kerr - p.3

TO: Kerry M. Stanley - p.3 FAX: 409-766-3931

the upper Galveston Bay area, of historical interest since 1836, the Battle of San Jacinto — (General Santa Anna's dawdling at Morgan's Point, where the Ship Channel now goes 'inland') — the Bay's future as a source of shrimp and other fish for area residents' consumption — the unique sporting activities at the 100-year old Houston Yacht Club — (right on the present Bayport Channel! —)

Upper Galveston Bay now is an outstanding natural feature of the Texas Gulf Coast. But Bayport at this site can make it a wilderness!

Sincerely,
Evan Kerr (Mrs. Henry B. Kerr)

22-18

APR 2 3 2002

April 21, 2002

XP 12761

Kerry M. Stanley
Regulatory Branch, CESWG-PE-RB
U. S. Army Corps of Engineers
P. O. Box 1229
Galveston, Texas 77553-1229

Subject: Proposed Bayport Container Terminal
Reference: USACE Public Notice dated 04 April 2002

Dear Mr. Stanley:

I am enclosing my comments relative to the proposed changes in the Houston Port Authority's application as described in the referenced Public Notice.

(1) Extending berm south of the proposed Cruise Terminal.

The lighting and noise of major concern is that to be generated by the container terminal- - not the cruise terminal. Cruise ships dock in the morning and are gone by early evening whereas container port operations are around the clock seven days a week. Further, cargo activities associated with cruise ships are not in the same league with the elevated container operations. The extension of the berm along the south perimeter of the proposed cruise terminal would have minimal effect on El Jardin residences. 3-52 17-2

(2) Concrete wall along the northern edge of the channel.

The proposed concrete wall would only protect the nearest 120 feet north of the wall from direct line-of-sight to the dockside cranes. This is only a marginal improvement at best. 3-53

(3) Addition of Loblolly Pine trees to the berm mix.

No information is presented on how much, if any, the addition of evergreen to the mix will reduce the DEIS predicted out-of-limits decibel levels. No statement is included which would indicate the size of trees to be planted nor time needed to reach maturity even if some benefits could ultimately be derived from this addition. 3-54

(4) Impact noise reduction systems on wharf "crane spreader bars".

In the DEIS, The PHA had already committed to the lowest level of noise in procurement of equipment so this is not a change. However, the question still remains on <u>what agency has approval authority</u> over purchase of equipment to meet these criteria should the Bayport site be approved. Left to the sole discretion of the PHA, this goal would be unenforceable. 3-55

(5) The USACE is correcting a major discrepancy in the DEIS regarding wetlands.

The referenced Public Notice does not identify the source of the erroneous data. If this information was contained within the HPA application and was accepted as correct by the USACE in the DEIS, it should be grounds for rejection of the application. 23-173

General Comments:

On page 5 of the USACE notice, the statement is made that if no comments are made by 04 May 2002, it will be considered that there are no objections. This could imply that all comments generated during the open period for the DEIS are discarded. 23-174

The additional modifications, as proposed in the 04 April 2002 Public Notice, only constitute marginal improvements at best. Nothing is included on air pollution (especially on the effects of less than 2.5 micron particles), recreation, safety (adjacent public highways) and the "needs and welfare" of a significantly larger residential population than exist at any other of the candidate sites. 23-175

While not a direct responsibility of the USACE, project costs are a concern in public statements by HPA executives. However, the loss of value of residential properties need to be weighed as well. This issue certainly falls into the "needs and welfare of the people". 6-136

Comments received by the USACE during the open period should only be tempered by the extent of the information contained in your referenced Public Notice but these open period inputs are essential in your consideration of this application. 23-176

If the USACE concludes that these superficial changes warrant disgarding all public comments received during the open season then the USACE needs to reissue the revised draft of the DEIS and entertain a new open period for public comment.

Sincerely yours

Richard B. Ferguson

Richard B. Ferguson
419 Cedar Lane
Seabrook, Texas 77586

YP 11265

Ross Beaudreau
538 Surf Oaks Drive
Seabrook, TX 77586

August 15, 2002

Mr. Kerry Standley
Regulatory Branch, CESWG-PE-RE
U.S. Army Corps of Engineers, Galveston District
P.O. Box 1229
Galveston, TX 77553-1229

Dear Mr. Standley,

RE: Revised Public Notice No. 2 (July 22, 2002)
Department of the Army Application Number 21520
(Bayport)
Port of Houston Authority Container Terminal

In Revised Public Notice No. 2, of July 2002, a mitigation concept is set forth that is different from those preceding it for this project, and it is unacceptable in several respects. 14-128

First, there is no mitigation proposed for impacts on "non-jurisdictional" wetlands. These are negative impacts of the proposed action and represent cumulative losses of a freshwater habitat type already seriously reduced all across Texas. 14-128

Second, no mitigation is proposed for the impacts on the open waters of the bay, or on tidal flats. Galveston Bay is a highly productive estuary. Open water and tidal flats habitats are both contributors to its productivity Depending upon whether one is looking at Revised Public Notice No. 1 or No. 2, there are either 310 14-128

acres of open water impacted or 127.3 acres of open water. The proposed cruise terminal development will impact upwards of 23 acres of tidal flats. Mitigation for these losses must to be included in the plans.

Third, there is no mitigation proposed for the loss of Neotropical bird habitat that will disappear if the Bayport site is developed. This is an impact that is considered within the scope of EPA's 404(b)(1) guidelines, and it should be considered in the analysis of alternatives. There is no indication that this factor has been considered in any way at all. 14-128

The environmental impacts of building this port at the Bayport site have been identified by the U.S. Fish and Wildlife Service as the *most damaging* out of all the alternative sites under consideration. This is very obvious for some of the alternative sites, where the habitat affected is not natural habitat at all, as at Bayport (a "green site"), but consists of dredge spoil disposal areas ("brown sites"), where any wetlands carry no legal classification. 2-196

Yours sincerely,

Ross Beaudreau

AUGUST 14, 2002

K. STANLEY
CESWG-OPE-RE
U.S. ARMY CORPS OF ENGINEERING

VP 11866

WITH THE PORT OF HOUSTON SUBMITTING AN AMENDED PERMIT APPLICATION FOR THE BAYPORT CONTAINER PORT, THERE SHOULD BE ALSO A SUPPLEMENTAL DEIS WHICH WOULD:

1) REEVALUATE AIR QUALITY, NOISE, LAND USE, WETLANDS AND ALL ASPECTS OF TRANSPORTATION —
2) REEVALUATE THE 50 FOOT BAYPORT CHANNEL IMPACTS —
3) REEVALUATE THE CUMULATIVE IMPACTS WITH THE CONCURRENT PROPOSED SAN JACINTO RAIL PROJECT —

23-266

SINCE 9-11-01, ENRON, WORLDCOM, THE RECOGNITION OF THE IMPACTS OF GLOBAL WARMING, ETC THE INTERESTS AND ATTITUDES OF THE PEOPLE OF THE UNITED STATES HAVE SIGNIFICANTLY CHANGED! DON'T YA'LL IN THE CORPS UNDERSTAND THAT? DON'T YOU GET IT?

Clay McCullough
CLAY E. McCULLOUGH
209 CONFEDERATE WAY
SEABROOK, TX 77586

August 15, 2002

YP 11867

Dear Mr. Stanley,

Because of the Port's amended permit application, I strongly urge that a Supplemental DEIS (SDEIS) be issued. This SDEIS should reevaluate air quality, noise, land use, wetlands, transportation, the 50ft. Bayport channel impacts, and cumulative impacts with the concurrent proposed San Jacinto Rail project because of the revised application. 23.266

Sincerely,

Mary Lynn Putnam
Lifetime resident of Harris County and 2nd generation Native Houstonian
218 Confederate Way
El Lago, Tx 77586
Phone No. 281-326-2621

J.J.Stout
422 Baywood
Shoreacres
La-Porte, TX 77571

VP11863

Thank you for keeping the public informed on the latest plans the Port of Houston have on the Bay Port Project, again you have informed me that they are still trying to force there plan.

Once again I am writing this letter to in form you I am totally against the Bay Port Project. 29-98

This project should not be given approval and should be moved from Bayport to another area, has we have protested since the beginning of the project and the changes you have shown are not going to improve the peoples life in this area. 2-197

I know you are aware this area voted 100% against the project and I personally will not accept this project no matter what they promise. We have enough problems in this area with the traffic and pollution from the chemical plants, the county at this time also have a pollution problem they want to increase the speed up to 70mph again and they have to come up with a recommendation on the pollution problem. The traffic will increase an extra 7000 trucks a day use hi-way 225 and 146 and also a new rail system this shows there is no concern for any of the residents in this area. 29-107 27-1

Jim Edmonds the CEO of the port and the board also the people who live north, east and west of this area who voted to accept this project have no concept what this project will do to the people and homes and roads in the area it will be no problem to them but a major one to us. 22-170

I hope you act on the following comments and also read the following comments:

1. The Port's amended permit application should trigger a Supplemental DEIS (SDEIES)
2. The SDEIS should reevaluate air quality, noise, land use, wetlands, transportation, 50 ft. Bayport channel impacts, and cumulative impacts with concurrent proposed San Jacinto Rail project, in light of the revised application.

23-266

The U.S Fish and Wildlife Service have asked you not to accept the EIS or issue a permit for the container cargo facility, also the Texas Parks and Wildlife recommends denial of the permit. 29-108

The local Texas congressmen and Mayors in our districts are against this project I recommend denial of the permit.

Sincerely

Mr. J.J Stout