

**Wetland Technologies Corporation, on behalf of
the *Mobil Mining & Minerals Company***

presents the:

MM&MC *Wetland Restoration Plan*

September 10, 1995

An approximately 35 acre site consisting of a
17 acre area of tidally influenced wetlands and uplands,
and an 18 acre area of freshwater wetlands and uplands;
located south of, and adjacent to the, Houston Ship Channel,
within the City of Pasadena, County of Harris, Texas

Table of Contents

General Information	1
Introduction	1
Project Location.....	2
Project Description	4
Proposed Tidal Wetland Design.....	4
Aerial Photograph of Tidal Wetland Project Area	6
Tidal Wetland Existing Contour Map	7
Photographs of Existing Conditions.....	8
Proposed Freshwater Wetland Design	9
Aerial Photograph of Freshwater Wetland Project	10
Freshwater Wetland Existing Contour Map	11
Photographs of Existing Conditions.....	12
Wildlife and Vegetation Survey	13
Topography and Drainage	13
Vegetation and Wildlife.....	14
Wetland Restoration Plan	16
Tidal Wetland Design Criteria.....	16
Typical Constructed Wetland Cross Section Map	19
Tidal Wetland Photographs	20
Construction Details	21
Soil Manipulation	21
Tidal Vegetation Planting Detail	22
Tidal Wetland Design Map.....	24
Tidal Wetland Excavation Map.....	25

Channel-Pool-Mound Design.....	26
Channel-Pool-Mound Cross Section Map.....	27
Channel-Pool-Mound Detail Map.....	28
Construction Detail Photographs.....	29
Pipeline Work Plan Details.....	30
Construction Detail Pipeline Photographs.....	32
Construction Detail Pipeline Map.....	34
Freshwater Wetland Creation Planned Construction Methodology.....	35
Freshwater Vegetation Planting Detail.....	43
Freshwater Wetland Design Map.....	44
Freshwater Wetland Excavation Map.....	45
Project Performance Criteria	46
After Construction Monitoring Plan	49
Literature References	55

General Information

Identification of Parties

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Environmental Consultant	Wetland Technologies Corporation 1831 Pinewood Court Sugar Land, Texas 77478 OFF: (713) 242-8734 FAX: (713) 491-0825

Introduction

This **Plan** is comprised of a summary of previous reports and plans (including photos and drawings) for review by Trustees assigned at some future date to monitor **Project** compliance (who may not be familiar with the history of the Settlement Agreement).

New Federal Standards: This **Restoration Plan** has been organized according to guidelines set forth in Federal Standards promulgated in the 3 book series on the subject of restoration of aquatic systems as follows:

- 1.) Kusler, Jon A. and Mary E. Kentula. 1990. *Wetland Creation and Restoration*. Island Press. Washington, D.C.
- 2.) National Research Council. 1992. *Restoration of Aquatic Ecosystems*. National Academy Press. Washington, D.C.
- 3.) Kentula, M. E., R. P. Brooks, S. E. Gwin, C. C. Holland, A. D. Sherman, J. C. Sifneos. 1993. *An Approach to Improving Decision Making in Wetland Restoration and Creation*. Edited by A.J. Hairston. U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR.

Research projects implemented by the Environmental Protection Agency's Wetlands Research Program (WRP) are designed to supply this information;(1) consequently, our firm has organized all of the aquatic systems restoration, creation, and enhancement plans according to these formats.

The latest publication (second edition) of item 3 above, announced that the information contained will be formatted (developed) into new Federal Standards to apply to all **Restoration Projects** subject to agency review within the United States; therefore care has been taken to prepare project plans in accordance to these guidelines.(1)

Project Location

The subject property, an approximately 33 acre tract of currently degraded land, is located south of the Houston Ship Channel at the **MM & MC** plant site, City of Pasadena, County of Harris, Texas.

Project Benefits

The **Planned tidally influenced site will be the only significant brackish water wetland located within this portion of the Ship Channel area.** Turbid water observed in the Ship Channel (at the site) during a period without rainfall exhibited characteristics of water heavily influenced by outfall from sewerage and industrial plants. Consequently, the **Project** is intended to provide the documented water cleansing effect of shallow water wetlands to a section of waterway that currently contains none.

Finfish Nursery Habitat: Rain water inflow, large project size, nutrient uptake, sediment trapping, and oxygenating effects of the new wetland may not be significant to overall Ship Channel water quality. However, it will significantly improve water quality within the immediate project area for marine nursery purposes; the success of (and the relative level of success of), which is the Primary Performance Criteria of the Project.

Habitat Creation and Species Diversity: Secondly, a somewhat diverse wildlife habitat may develop over time in the Freshwater northwestern quarter where the final system outfall is planned to be located. This final surge pond will have shallow areas 10" to 24" in depth to provide habitat for aquatic vegetation. The various floodplain tree species to be planted in this work area will promote an increase in total species diversity.

Rainwater is planned to be collected separately within two freshwater pools specified to be excavated in the tidal area, in order to provide a constant source of relatively clean drinking water for area wildlife.

Nutrient Modification: Thirdly, there may be some improvement in reduction of nutrients remaining in MM & MC effluent outfall into the Ship Channel. The Freshwater system could remove a measureable amount of nitrogen remaining in effluent after wastewater plant treatment. Also, other nutrients will be modified to lower levels.

Finally, pH of waters within both Project areas will tend to be adjusted towards neutral irrespective of whether they enter the systems as acidic or alkaline.

Project Description

General Design Criteria

Section I: Tidal Wetland Component

General Concept: This Project component involves the development of approximately 17 acres of created and enhanced tidal wetland, as is more fully described within the site **Wetland Restoration Plan** following on page 16. The project concept envisions creation of good quality wetland comprised mostly of brackish water finfish nursery habitat; with a small fresh water interface and a very lengthy upland edge (compared to the upland size).

The Plan is developed directly from field observation of the proposed site's existing conditions on October 26, 1992. As the subjective estimate of wetland "quality" is directly related to complexity of different adjacent habitats; we have included an additional biodiversity effect from development of freshwater wetlands on the 16 acre balance of the subject tract, and 60 acres of riparian habitat directly adjacent of the south boundary.

More specifically, this particular design increases the effective habitat potential of the marine nursery (both area and quality); with a small amount of year-round fresh drinking water provided to the existing wildlife population. Combined with the 16 acre balance of the subject property, and with the adjacent Cottonpatch Bayou 60 acre watershed; the entire discrete ecosystem will contain a large amount of "edge effect", which indicates a substantial increase in biodiversity to be available in the immediate area.

Wetland Creation: Specifically, the **Project** will involve lowering the elevation of approximately 16 acres of sloping upland area to diverse shelf levels of 0" to 18" height at mean low tide. Up to 70% of these shelves would be exposed at mean low tide. Additionally, two new inlets/outlets would be excavated to the Ship Channel; in order to provide additional dissolved oxygen through the resulting flushing action, and to provide access to mature individual fish.

Wetland Enhancement: It appears that the site's existing 1 acre brackish water wetland is very low quality habitat due to the loss of oxygen when the falling tide "isolates" the remaining pool during hot weather. **Therefore, improvement of the tidal pool inflow is added to the project credit as "enhancement", for a total restoration credit of 17 acres.**

Freshwater Collection: Freshwater pool #1--A small part of the upland area to be lowered below the existing elevation would act as a **rainwater collection system** when cut off from the **MM & MC** plant drainage. This will be accomplished by cutting the slopes back on the eastern side of the outfall ditch, shaping a collector ditch around the planned soil storage area, and falling to a small excavated pool.

The resulting small freshwater pool will be located above the brackish water interface (constructed above historical high tide), in order to provide a year-round source of good quality drinking water for area wildlife.

Freshwater pool #2--An existing 0.15 acre freshwater wetland (containing mostly *Typha sp.*) will be avoided entirely, and enlarged by excavating a pool about 4' deep into the surrounding uplands to allow for **possible additional rainwater collection**. The storm water will runoff from the upland area located directly adjacent to the far east boundary of the tidal project. This upland area will be lowered to a gentle slope downwards to the north; with a storm water swale extending to the enlarged wetland such that rainwater will eventually collect within the pool. If so, it may serve as an additional source of drinking water for various species of mammal and bird populations.

Existing Upland Area: The approximately 1 acre of very high upland located along the northwest border of the tract would be avoided (existing elevation left as-is); and act as a buffer between the Ship Channel and the *brackish water project as it contains relatively good upland habitat value*. This area includes mature tree specimens of cottonwood, hackberry, and cedar elm. It also contains a variety of established berry producing species currently being utilized by the existing wildlife population.

An additional 16 acres of upland (balance of the subject tract) would become part of the **Project** by relocating the existing storm water channel to flow directly north from the **MM & MC** plant, and excavation of the uplands into freshwater wetlands for a total **Project** area of approximately 33 acres.

Existing Conditions



General Area Photograph: Aerial photo of Restoration Project area, with adjacent lands & waters.

Section II: Freshwater Component

General Concept: The **MM & MC (001) outfall** will be relocated from the tidal region of the **Project** site; and will be enhanced by construction of serpentine meander ditches and several associated large shallow freshwater wetlands.

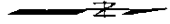
Wetland Creation: Conceptual design of the (secondary) **Freshwater Project** specifies construction of two surge ponds in order to prevent flooding the site, whether from daily outfall surges, and/or excessive rainfall events, as is more fully described in the following Wetland Restoration Plan and attached drawings. **The watercourse between ponds and large shallow wetlands is specified to "meander" in order to increase total time that plant outfall water remains in the system.**

In several places where the meanders reverse course, shallow wetland shelves will be leveled (not excavated) and planted with site-adapted plant species. This wetland area assists in retaining the plant outfall water for a longer period of time in the system.

Detention Capacity: One of the surge ponds will be located directly beneath the treatment plant outfall, and the other specified holding pond is to be located at the bottom of the slope, directly before outfall into the Ship Channel. The two surge ponds will contain a long term detention capacity (retention time is to be 24 to 48 hours, not including stormwater) of standing water from 4' to 8' deep below normal pool level; and will additionally provide a floodpool capacity above normal pool level of 2' to 4' for short term retention in order to slow streamflow velocity. Large shallow wetlands to be associated with (at the edge of) these surge ponds are specified to be predominantly from 0" to 10" in depth.

Grading of specific hydrologic elevations are to be conducted such that the deeper surge pond outfalls into shallow wetlands and meanders within the water's flow path; thereby providing extended contact time with the naturally occurring microbial community in an alternating aerobic/anaerobic cycle.

Planting: Floodpool areas above normal pool level, and those areas to be 0" to 10" in depth will be planted with vegetation ("mature" plants and "seedbank") adapted to the site. Some mature aquatic plants from off-site may be introduced. The final shallow wetland will have its edges planted with seedlings of site-adapted floodplain tree species (ie. hackberry, cottonwood, and willow); along with some cypress, water oak, willow oak (which may or may not survive) being introduced into the restoration project.



DATE	10-1-50	SCALE	1" = 50'
PROJECT	Mobil Mining and Minerals	PROJECT NO.	33373
DESIGNED BY	CAO	CHECKED BY	DR
OPERATING DIVISION	10-10-9	PLANT	PASADENA
DATE	10-1-50	FILE NO.	P-1514 G



Mobil Mining and Minerals
 1000 GARDNER A. BRADLEY, JR.
 PASADENA, CALIF. 92301

METLANDS EXISTING
 CONTOUR MAP
 SATWATER SEC. 11091

Wildlife and Vegetation Survey

This survey was conducted on October 26, 1992 by Elizabeth Oakes, Wildlife Biologist. Atmospheric conditions were characteristic of the season, with little cloud cover and the temperature rising to 90 degrees (F). No precipitation occurred during the field inspection, and the area had received little or no rainfall since mid-September, 1992.

Topography and Drainage

This 33 acre tract is located on the banks of the Houston Ship Channel immediately adjacent to the MM & MC facility. The tract is completely undeveloped.

Topography ranges from 18 feet to sea level, with tidal influence of approximately 1 (one) acre surface area (the tidal pool) on the western side of the tract, and a man-made outfall ditch into the Houston Ship Channel.

Evidence of drainage into and water collection in several low points on the tract was noted, including water-stained vegetation, hydrophytic vegetation and moist soil.

Vegetation

Vegetation on the tract is characteristic of disturbed, but undeveloped acreage in the area of the study site and consists of a mixture of native and invader species. Species observed included *Ambrosia trifida* (ragweed) which was dominant on the tract; *Sorghum halepense* (Johnson grass), *Cynodon dactylon* (bermuda grass), *Digitaria sanguinalis* (crab grass), *Setaria lutescens* (yellow foxtail), *Cyperus esculentus* (chufa), *Amaranthus retroflexus* (red-root amaranth), *Phytolacca decandra* (pokeweed), *Portulaca oleracea* (purslane), *Asclepias syriaca* (milkweed), *Ipomoea purpurea* (morning glory), *Datura stramonium* (jimson weed), *Eupatorium serotinum* (thoroughwort), *Vitis spp.* (wild grape), *Ampelopsis arborea* (peppervine), *Cissus incisa* (ivy treebine), and *Solidago canadensis* (goldenrod).

Tree cover on the tract is minimal and consists of isolated specimens of *Populus spp.* (cottonwood), *Celtis occidentalis* (common hackberry), *Salix nigra* (black willow), and *Ulmus crassifolia* (cedar elm). The dead trunk of what appeared to have been a *Taxodium distichum* (bald cypress) was noted near the tidal pool.

Vegetation around the tidal pool and in low points on the tract included common hydrophytic species such as *Spartina patens* (saltmeadow cordgrass), *Pluchea purpurascens* (saltmarsh fleabane), *Lycium carolinianum* (Carolina wolfberry), *Sesbania drummondii* (rattlebush), *Heliotropium curassavicum* (seaside heliotrope), *Iva frutescens* (marsh-elder), *Baccharis halimifolia* (baccharis), *Juncus roemerianus* (needlerush), *Scirpus maritimus* (saltmarsh bulrush), *Cyperus spp.* (umbrella-sedge), *Rhynchospora spp.* (beak-rush), *Typha angustifolia* (narrow-leaved cattail), *Cardiospermum halicacabum* (balloon-vine), *Andropogon glomeratus* (bushy bluestem), and *Ptilimnium capillaceum* (mock bishop's weed). Other hydrophytic species may be present on the site but dormant due to recent drought conditions.

Wildlife

Wildlife species on the tract were determined either by direct ocular observation of individuals or by examination of tracks, burrows, bones, feathers and scat.

The largest animals on the tract are *Odocoileus virginianus* (whitetailed deer). Tracks, browse marks and day beds were observed in the field. The tract may provide forage and cover for a doe and fawn, with the animals swimming the narrow Ship Channel area or crossing the fence to adjacent undeveloped areas for additional forage.

Canis latrans (Coyote) tracks and scat (containing rabbit hair and bones) were observed on the tract. This animal may also be swimming onto the tract and/or crossing through the fence.

Evidence of *Dasyurus novemcinctus* (armadillo) and *Procyon lotor* (raccoon) were observed in the form of tracks. *Rattus norvegicus* (Norway rat) would be presumed to be on the tract due to its immediate proximity to the Houston Ship Channel. A *Sylvilagus aquaticus* (swamp rabbit) was observed on the tract.

Bird species observed on or near the tract included *Phalacrocorax spp.* (cormorant), *Ardea herodias* (great blue heron), *Leucophoyx thula* (snowy-egret), *Larus delawarensis* (ring-billed gull), *Mimus polyglottos* (northern mockingbird), *Passer domesticus* (house sparrow), and *Zenaida macroura* (mourning dove). Evidence of the presence of a species of owl was observed in the form of droppings beneath a cottonwood tree, and evidence of a hawk feeding was found in the form of mockingbird feathers from a recent kill.

No bird nests were observed on the tract during our field reconnaissance. Trees on the site are isolated. Lower branches appear to have been heavily browsed.

The only evidence of reptile life found on the tract was near the mouth of the man-made drainageway at the eastern side of the tract. A species of small water snake was briefly observed but was too far away for identification.

Common minnows were observed in the water, and a large kill of *Ictiobus cyprinellus* (buffalo fish) was observed in the Ship Channel tidal area adjacent to the tract, the result of evaporation, deoxygenation, and water levels below the minimum required to sustain this fish population.

A turtle shell (probably a *Pseudemys scripta* [pond slider]) was found on the tract. No amphibians were observed during our field reconnaissance due to drought conditions.

Incorporated Recommendations for Bioremediation and Habitat Enhancement: The following items have been incorporated into the Plan from recommendations by Ms. Elizabeth Oakes, Wildlife Biologist.

- 1.) Dredge two new outlets into the existing pool to create a tidal flushing action, which will promote oxygenation and allow spawn to utilize the extensively vegetated shallow flats along the edge of the tidal pool. This tidal pool appeared to be anaerobic at the time of our field reconnaissance.
- 2.) Dredge a shallow pond along a man-made drainageway to permit freshwater to collect, which will supply a constant source of drinking water to mammals and birds on the tract. Create rills along the watercourse with concrete or other stone-type breakwaters to promote aeration.
- 3.) Enlarge the existing "low point" intermittent wetlands on the tract uplands such that additional hydrophytic vegetation species will grow in these areas, and aquatic species (other than plants) will have breeding habitat.
- 4.) Plant additional trees and bushes for food source, nesting sites and cover along the upper slopes of the tract.

Wetland Restoration Plan

This Plan is comprised of two separate components: 1.) **Tidal Wetland Component**-the construction of approximately 16 acres of tidal wetland, enhancement of approximately 1 acre of marginal wetland into good quality wetland, including a portion of the site's lower tidal pool, and incorporation of a constant supply of fresh drinking water for area wildlife populations; and 2.) **Freshwater Component**-the enhancement of the MM & MC "001" outfall by design of constructed surge ponds, serpentine meander ditches and associated shallow freshwater wetlands.

Section I: Tidal Wetland Design Criteria

Approximately 16 acres of the higher ground is suitable for conversion from upland to good quality wetland, along with enhancement from marginal wetland to good quality wetland of a 1 acre portion of the site's lower tidal pool.

Planned Construction Methodology

This **Plan** presents details of 1.) elevation levels to be excavated, and 2.) the particular construction methodology to be utilized in "creating" these elevations, as shown on the attached project grading contour drawings in 11" x 17" format (to-be-excavated elevations).

Marine Hydrology: will be provided by cutting in two new inlets to the Ship Channel. One inlet will be located to the north where MM & MC's effluent currently outfalls to the Ship Channel. This area will be deepened to approximately 2' below mean low tide (as shown on the accompanying Tidal Wetland Creation Map and attached Grading Drawings) creating a flushing action currently not present at the proposed site. The other new inlet will be located at the western boundary and will be dredged to the minimum 2' depth level. **The flushing activity is necessary to achieve the primary goal of creating good quality marine nursery habitat.**

Currently, mean low tide on a one tide day, or a very low tide below mean low tide, will cause the existing pool to experience a sudden lowering of dissolved oxygen in warm weather. This low oxygen level will prevent mature finfish from entering the area approximately 50% of the spawning season. Additionally, any successfully fertilized eggs deposited in the tidal pool may be damaged by a sudden increase in temperature coupled with a loss of oxygen.

Therefore, excavating two new inlets will allow flushing activity to be introduced into the area; raising the dissolved oxygen level, and providing a more constant temperature environment. Also, because the new inlets will be well below historical low tide, an escape will be provided for individual finfish.

Tidal Project's Freshwater Hydrology: The newly constructed watershed's first wetland will be a small shallow freshwater pool to hold the site's runoff for the purpose of providing fresh drinking water to edge-dwelling wildlife. This is to be accomplished by cutting the slopes back on the eastern side of the existing outfall ditch, and installing a collector ditch (lip) around the planned soil storage area, falling to a freshwater pool to be located above the brackish water interface (constructed above historical high tide).

The watercourse will then flow through a bed of locally available reed species to subject the freshwater to remedial microbial activity present around their rhizomes. This activity will also add a small amount of dissolved oxygen to the streamflow.

The water will eventually meander into the tidal wetland area, and will be planted with appropriate fresh/brackish vegetation species (mature plants and seedbank), such as umbrella-sedge, then cattail, and then cordgrass as it falls into the marine zone below mean high tide.

Secondly, an existing 0.15 acre freshwater wetland (to be avoided and enhanced) will be enlarged by excavating into the surrounding uplands to allow for **possible additional rainwater collection**. The upland area located directly adjacent to the far east boundary of the Tidal project will be lowered to a gentle slope downwards to the north; extending to the enlarged wetland such that rainwater will eventually collect in the excavated pool.

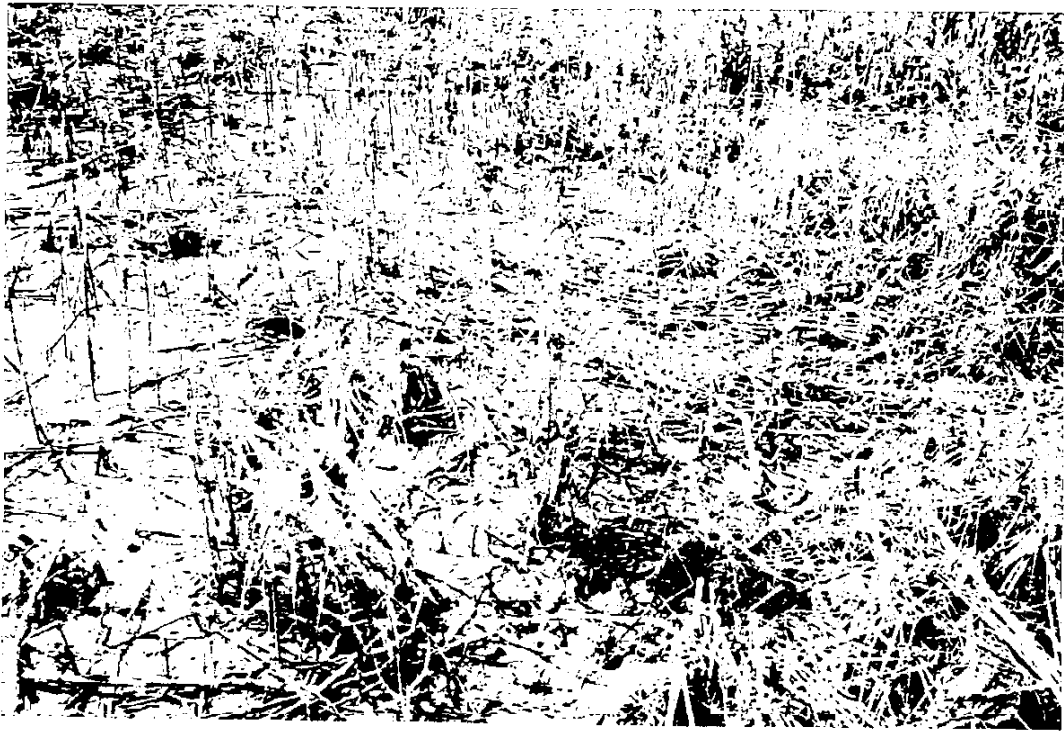
Upland (existing) Elevations: are to be avoided in order to provide a long "edge effect" to enhance biodiversity. Care will be taken to leave all of the standing mature trees and associated understory to aid the site establishment; by specifying constructed wetland locations to be in open, lower areas. This will ensure small, irregular, natural wetland shapes with complex, winding watercourses below the trees.

Small humps will be created, and islands left in the wetland project area (described as a **Channel-Pool-Mound Complex**). These will be planted with tree seedlings of floodplain species.

In addition to the above described tidal wetland construction project, the adjacent 16 acre upland tract will be added to the site's total restoration acreage by relocating the **MM & MC** plant outfall channel northward to supply a separate freshwater wetland construction project. This upland is differentiated from the very dense understory-overstory avoided upland; as it consists entirely of bermuda grass. Discrete stands of loblolly pines, live oaks, and other tree species will be planted to create a buffer between the freshwater section, and the **Planned** tidally influenced project.



Existing Conditions: This photo represents the center of the Tidal Project subject tract, across an existing 1 acre brackish water pool to the upland fringe of very high elevation. Some scattered mature trees of various species can be seen in the background and the Ship Channel is located directly behind the upland.

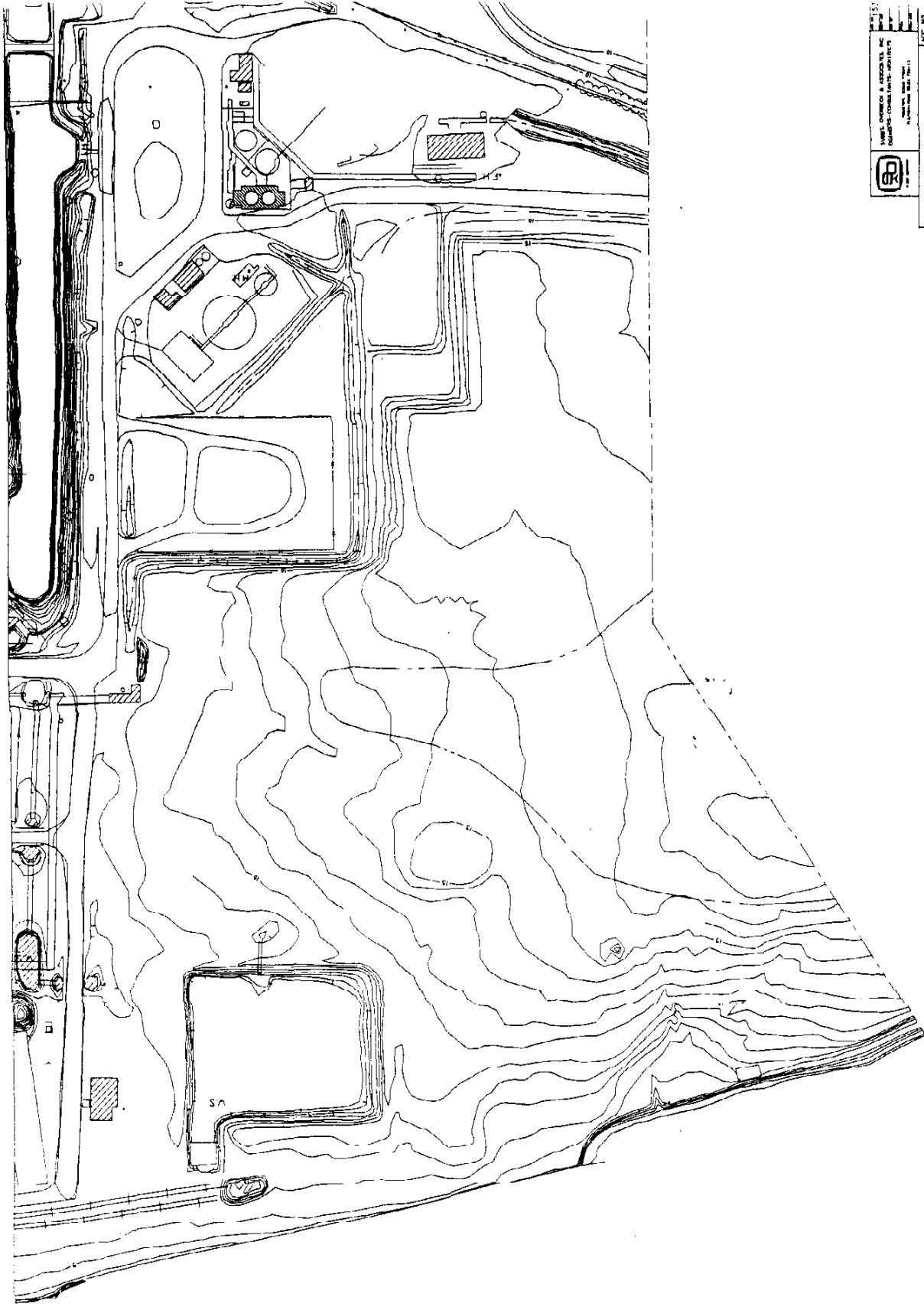



Close-up: A close-up of the tidally influenced edge of the existing wetland. 1.) Various plant species appear to be in poor health. 2.) Evidence of low oxygen level due to recent algae bloom left on the mud flat by receding tide.

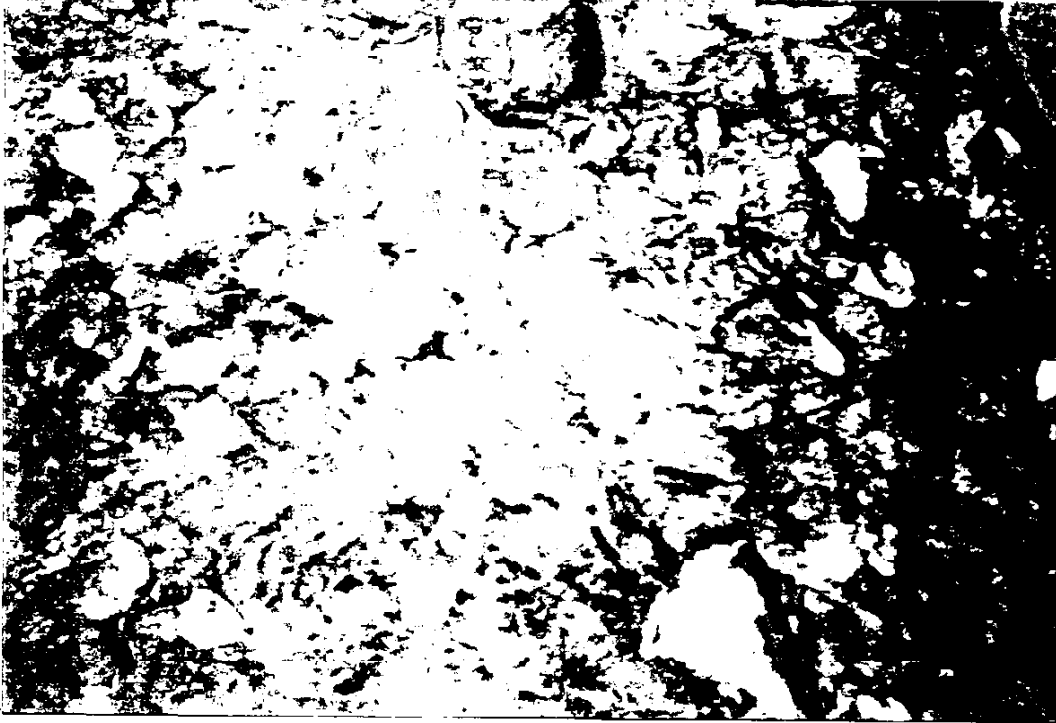
Existing Conditions Detail



Proposed Work Area: High resolution aerial photo of the Freshwater project work area.



		METLANDS EXISTING CONTOUR MAP FRESHWATER SECTION	
DRAWN BY CAD	DATE 10-18-83	SCALE 1" = 50' JOB NO. 100	SHEET NO. 1
CHECKED BY X	DATE X	OPERATIONS APPROVAL PASADENA	FILE NO. P-13616-0
MOBIL MINING AND MINERALS COMPANY 8000 WEST PASADENA BLVD., PASADENA, CA 92363		PROJECT NO. 100	



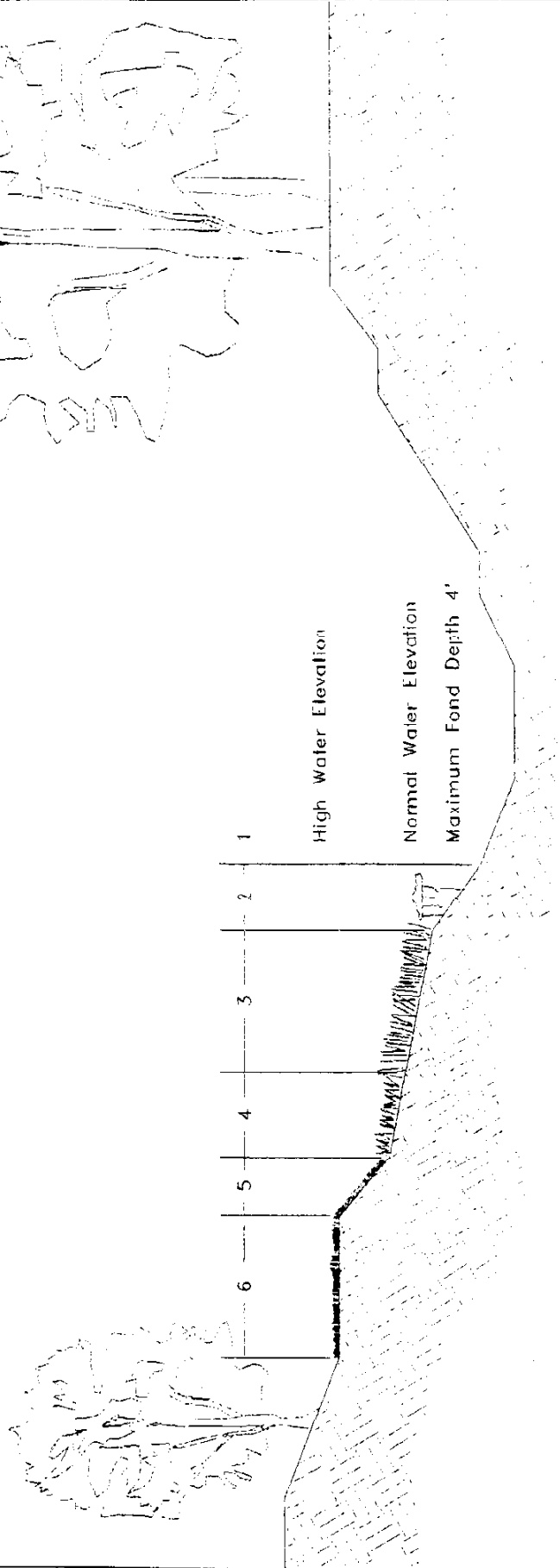
Interface Area: This is the interface area where the current outfall streamflow meets the tidal line; algae growth is reduced as it is diluted by Ship Channel waters, therefore the existing effluent contributes more nutrients than is contained in the receiving waters.



Treatment Plant Outfall: The current outfall channel and small wetland areas develop thick algae mats due to constant nutrient input. This area is directly adjacent to the treatment plant outfall, and algae accumulation is observable on the stream bottom downslope to the tidal line.

Typical Constructed Wetland

- 1 Open Water
- 2 Aquatic Vegetation
- 3 Erect Emergent Vegetation
- 4 Wet Prairie/Sedge Meadow Vegetation
- 5 Wet Mesic/Mesic Vegetation
- 6 Existing Upland Vegetation to Remain



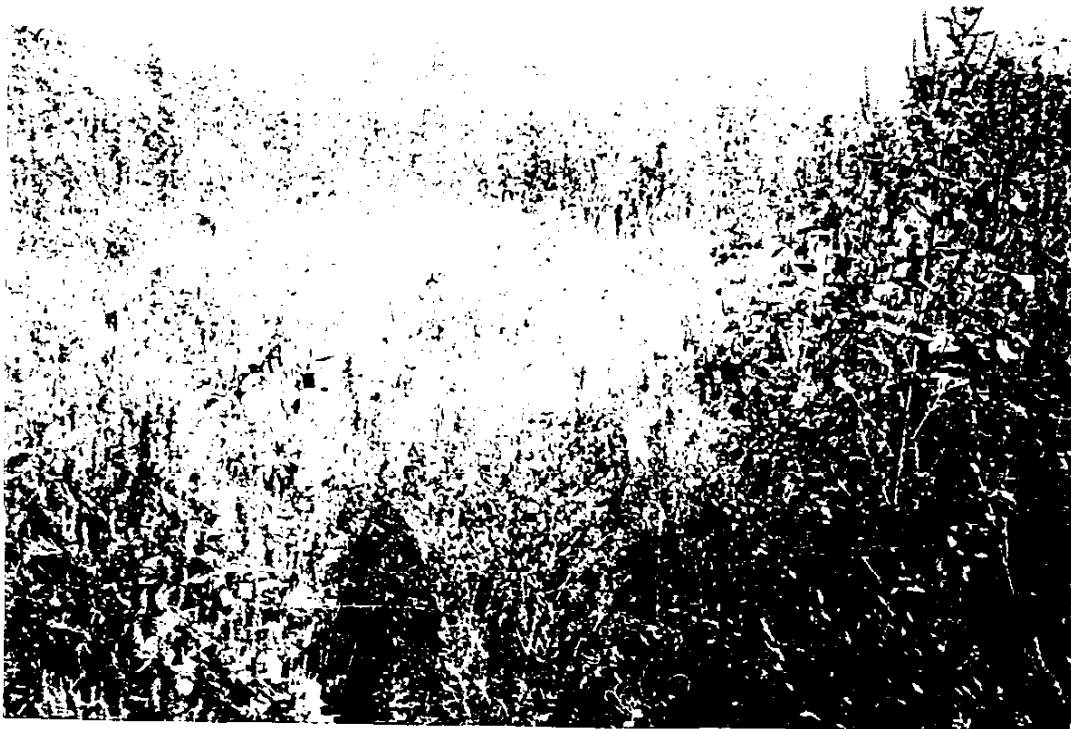
Wetland Technologies Corp.
 1831 Pinewood Court
 Sugarland, Texas 77478
 (713) 242-8734

Typical Constructed Wetland Cross Section
MOBIL MINING & MINERALS CO.
Tidal Wetland Creation Project
 Pasadena, Texas

Drawn By: **SG**
 Date: **12-16-94**
 Sheet: **19** of **48**
 Project: **MM01**



New Inlet Location: View from existing culvert through current plant outfall to the Ship Channel. This area will be deepened to provide tidal influence to the rear of site. The new depth will be at least 2' below mean low tide to provide finfish escape during extreme low tide. One other new inlet will be dredged to the minimum 2' depth level to provide a tidal flush across newly created brackish water wetlands.



Close-Up of Typical Project Work Area: This photograph is representative of the 17 acre tidal project work area. Vegetation breakline in the background marks the edge between lower elevations to be excavated, and the higher uplands to be left as-is (avoided).

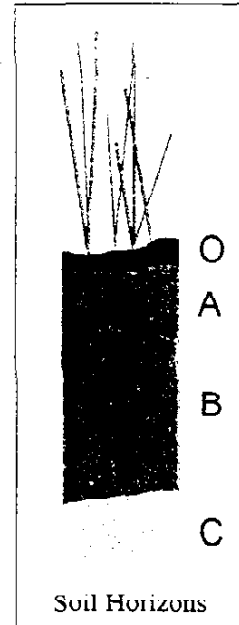
Construction Details

Soil Manipulation Methodology

This Section consists of significant construction details: as follows:

Excavation:

- a.) Existing desirable plants will be removed by hand, watered, and stored until planted, and then
- b.) removal and storage of the "O" horizon (organic layer) which consists of the very thin ($\frac{1}{2}$ to 2") layer of living plant material, decayed organic matter and most importantly the **seedbank**, and then
- c.) removal and storage (piled separately) of the biologically living **topsoil** containing soil microorganisms ("A" horizon just below the "O" horizon), and then
- d.) preliminary contours are to be excavated into the remaining soil **substrate** within the **Marsh Project** area (and if designated to be a planting shelf) to a level about 6" below the designed final grade, all of which is to be removed from the construction site.



These **substrate** materials are to be hauled to the **Freshwater Project** area, **Project** area, and utilized for construction of it's preliminary contours where appropriate.

Fine Grading:

- a.) Where a planting shelf is specified to be constructed, the biologically living **topsoil** ("A" horizon) material is to be **lightly** replaced to a depth of about 6", spread **without any additional leveling that may cause compaction**, and
- b.) the "O" horizon containing the very important **seedbank** material is **lightly** replaced on the **topsoil without any additional leveling that may cause compaction**.
- c.) During preparation of the detailed **Work Plan**, a representative sample of each of the above described **seedbank** materials is to be deposited at the intended **tidal elevation** in order to determine from it's subsequent germination whether the plant species is appropriate for the **Marsh Project**.

When possible, undesirable and invasive plant species will be noted and the **seedbank** "donor area" rejected if it fails to meet project criteria related to these species.

JH

MM & MC Plan

To Be Excavated

FRESHWATER
DRINKING POOL

EXCESS
EXCAVATED
SOIL STORAGE

16 ACRE
BALANCE OF TRACT

PROJECT
BOUNDARY
12' ELEVATION
LINE

HISTORICAL
TRAIL LINE
REFUGIARY

LOW TIDE
REFUGIARY

FENCED
PROPERTY LINE

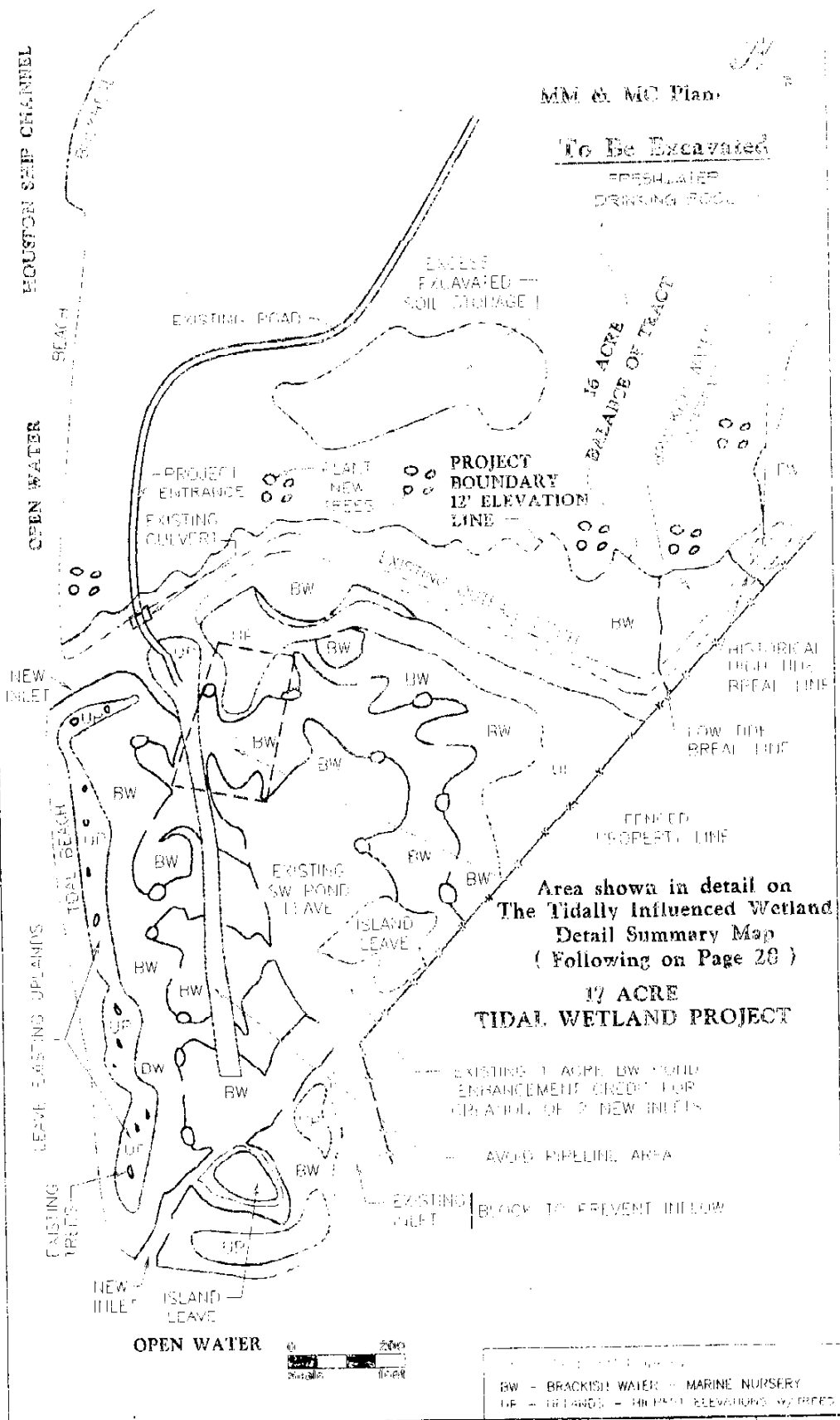
Area shown in detail on
The Tidally Influenced Wetland
Detail Summary Map
(Following on Page 28)

17 ACRE
TIDAL WETLAND PROJECT

EXISTING 1 ACRE LW POND
ENHANCEMENT CREDIT FOR
CREATION OF 2 NEW INLETS

AVOID INFILL AREA

EXISTING
INFILL BLOCK TO PREVENT INFLOW



Wetland Technologies Corp.
 1831 Pinewood Court (713) 242-0734
 Sugarland, Texas 77478

MOBIL MINING & MINERALS CO.
 Tidal Wetland Restoration Plan
FINAL DESIGN

Drawn By	SG	Sheet	24
Date	1-11-95	of	48
Drawn / File	MM/CREATION	Project #	MM01

Tidal Vegetation Planting Detail

Methodology: Existing mature wet meadow, aquatic, and emergent brackish water wetland plants will be lifted by hand prior to soil manipulation and excavation, and transported to a prepared trench where they will be watered daily if necessary. Seedbank material containing seeds of site-adapted plant species will also be utilized.

When excavation is complete and planting shelves are prepared, seedbank material will be spread over planting shelves, and mature plants will be transported back to the work area and hand planted at the correct elevations.

Stands of loblolly pines, live oaks, and other native tree species will be planted to create a buffer between the 16 acre freshwater section, and the tidally influenced project.

Brackish Water Plant Species List

The following list of the existing site-adapted plant species are to be planted both as seedbank material and mature plant transplantation. We expect the bulk of successful plant species to come from seedbank material. Percent survival of those plants germinating from seedbank material is expected to be about 80%, and those mature plants to be transplanted should achieve approximately 25-30% survival.

Within the next 3 years, areal coverage of those plants planted from seedbank, along with transplanted mature plants should cover 60% of the project area. Full 100% coverage within the next 5 years may be possible.

Suitable Plant Species Available On-site

Setaria hutescens (yellow foxtail)

Spartina patens (cordgrass)

Pluchea purpurascens (saltmarsh fleabane)

Juncus roemerianus (needlerush)

Scirpus maritimus (saltmarsh bulrush)

Cyperus spp. (umbrella-sedge)

Ptilimnium capillaceum (mock bishop's weed)

Additional Plant Species: In addition to the above existing plant source, mature *Spartina alterniflora* will be obtained from an off-site origin and planted in those areas flooded daily; eventually transitioning to the existing site-adapted species such as *Spartina patens*, all to be planted in the zone from mean high water level to the maximum height of spring and storm tides. *Spartina alterniflora* rhizomes will be planted at a maximum of 12" x 12" spacing (minimal root material), and is to be no less than a 36" x 36" spacing depending on the size of plant root mass.

A native plant landscaping company who has an authorized source of *Spartina alterniflora* is specified; consequently, obtaining this particular species of cordgrass will not result in the destruction of a *Spartina* saltmarsh.

