



MacMILLAN ASSOCIATES, INC. CONSULTING ENGINEERS
4101 NORTH EUCLID AVENUE BAY CITY, MICHIGAN 48706

**FEASIBILITY STUDY
FOR
STABILIZATION AND PRESERVATION
OF THE
DAVIDSON DRY DOCK
VETERANS MEMORIAL PARK
FOR THE
CITY OF BAY CITY, MICHIGAN**

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NATURAL RESOURCES
LAND & WATER MGMT.

FEASIBILITY STUDY
FOR
STABILIZATION AND PRESERVATION
OF THE
DAVIDSON DRY DOCK
VETERANS MEMORIAL PARK
FOR THE
CITY OF BAY CITY, MICHIGAN

Prepared by:
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This document was prepared in part through financial assistance provided by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration authorized by the Coastal Zone Management Act of 1972.

PURPOSE

The purpose of this report is to study the present condition and usage of the Davidson Dry Dock, and provide recommendations for it's stabilization, preservation and future utilization.

INTRODUCTION

The Davidson Dry Dock, located within the Veterans Memorial Park, is the last vestige of the wooden ship building industry that was an important factor in economic growth and prosperity of Bay City, Michigan in the late 1800's and early 1900's.

The dry dock was completed in November of 1900 and was used throughout the years for the repair and rebuilding of wooden ships. The dry dock was last used in 1931.

The dry dock is 455 feet long and 80 feet wide, with a width of 60 feet at the entrance. As constructed, the depth of the water in the dry dock was between 14 and 6 feet, depending on the water level of the Saginaw River. The dry dock could be filled in 1 1/2 hours, and pumped dry in under 2 hours.

The dry dock is located in the south portion of the Veterans Memorial Park on the west bank of the Saginaw River in Bay City, Michigan. In recent years, the park has seen extensive renovation with construction of the Kantzler Arboretum, the construction of the Riverwalk Fishing Pier, and the construction of the Liberty Harbor Municipal Marina. Stabilization of the riverbank through utilization of sheet piling and riprap, and construction of paved walking and jogging tracks is ongoing. A large storm sewer pipe discharges into the dry dock on the west end.

CONDITION OF EXISTING STRUCTURES

The commercial diving division of Townsend and Bottom Services Group, Inc. was retained to perform a visual and tactile inspection of the condition of the Davidson Dry Dock. On May 22, 1992, this inspection was accomplished and was recorded on audio/video tape. The quality of the visual portion is poor due to the extreme turbidity of the water in the dry dock.

A summary of the audio portion of the inspection is included in the appendix of this report, Exhibit #2.

SUMMARY

The following summarizes the conditions which were observed by the diving team during the inspection:

1. The gate of the dry dock has not been operable for many years, but remains across the entrance. The gate was constructed of wood and the top has deteriorated considerably. The gate is leaning into the dry dock, and normally is not visible.
2. The bottom of the dry dock has filled with sand, silt and debris. The water is presently about seven to eight feet deep, versus the original depth of fourteen to sixteen feet deep. The bottom surface is very loose and easily disturbed.

3. It appears the dry dock was originally constructed of wood, and later a non-reinforced concrete topping and cap was applied. The wood portions were found to be deteriorated at all depths, and in many areas the concrete has cracked and fallen away.
4. The concrete cap has cracked into blocks, and in some areas has fallen into the dry dock.
5. There is visual evidence that the soil around the dry dock has settled causing the dry dock walls to settle and translate, resulting in the top of the dry dock wall to be underwater.

Exhibit #4 presents photos which document the present condition of the visible portion of the dry dock.

CONCLUSION

There are many external forces acting on the dry dock structure which have caused the deterioration noted. The park areas around the dry dock have been backfilled creating soil surcharge loads. Ice, water, and the freeze/thaw cycle of many winters has promoted deterioration of the concrete surfaces. The continual exposure to water has deteriorated the structure of the wood. The lack of maintenance for approximately 60 years has allowed the external forces to deteriorate the dry dock un-checked.

The dry dock will continue to deteriorate due to the external forces discussed. The area immediately adjacent to the dry dock poses a hazard to persons, due to the unevenness of the grade and the condition of the concrete cap.

The condition of the concrete and wood is such that repair is not practical. A complete re-building from new materials would be the only alternative to restore the appearance to it's original condition.

The walls of the dry dock are at a slope of approximately 60° from horizontal. The surface of the water in the dry dock is normally within three feet from the top of the sloping walls. Under extreme conditions, the water surface would be six feet below the top of the walls.

In it's present condition, we feel that catastrophic failure of the dry dock walls should not occur, due to balancing of the soil and hydrostatic pressures on either sides of the wall. We would expect the concrete cap, wall alignment and top elevation to continue to move and subside. The dry dock can remain with no repairs; however, the areas adjacent to the water are a hazard that should be resolved.

The dry dock must remain open for the discharge of storm water from the storm sewer which empties into the west end of the dry dock.

RECOMMENDATIONS

The historical value of the dry dock is an asset to the community. The dry dock is on the Michigan Register of Historic Sites. Stabilization and preservation of the dry dock should be undertaken to better utilize the potential of the area for recreational purposes.

Use

Possible uses of the dry dock include:

1. Site for a museum vessel.
2. Stilling pond for radio controlled model boating.
3. Fishing, primarily adapted for the handicap.
4. A continuation of the Riverwalk system for relaxation and recreation.
5. For historic and educational markers to depict and explain how a dry dock functioned ninety years ago.

Stabilization & Preservation

We recommend the dry dock structure be preserved and stabilized in it's present condition. To achieve this, the following construction is required:

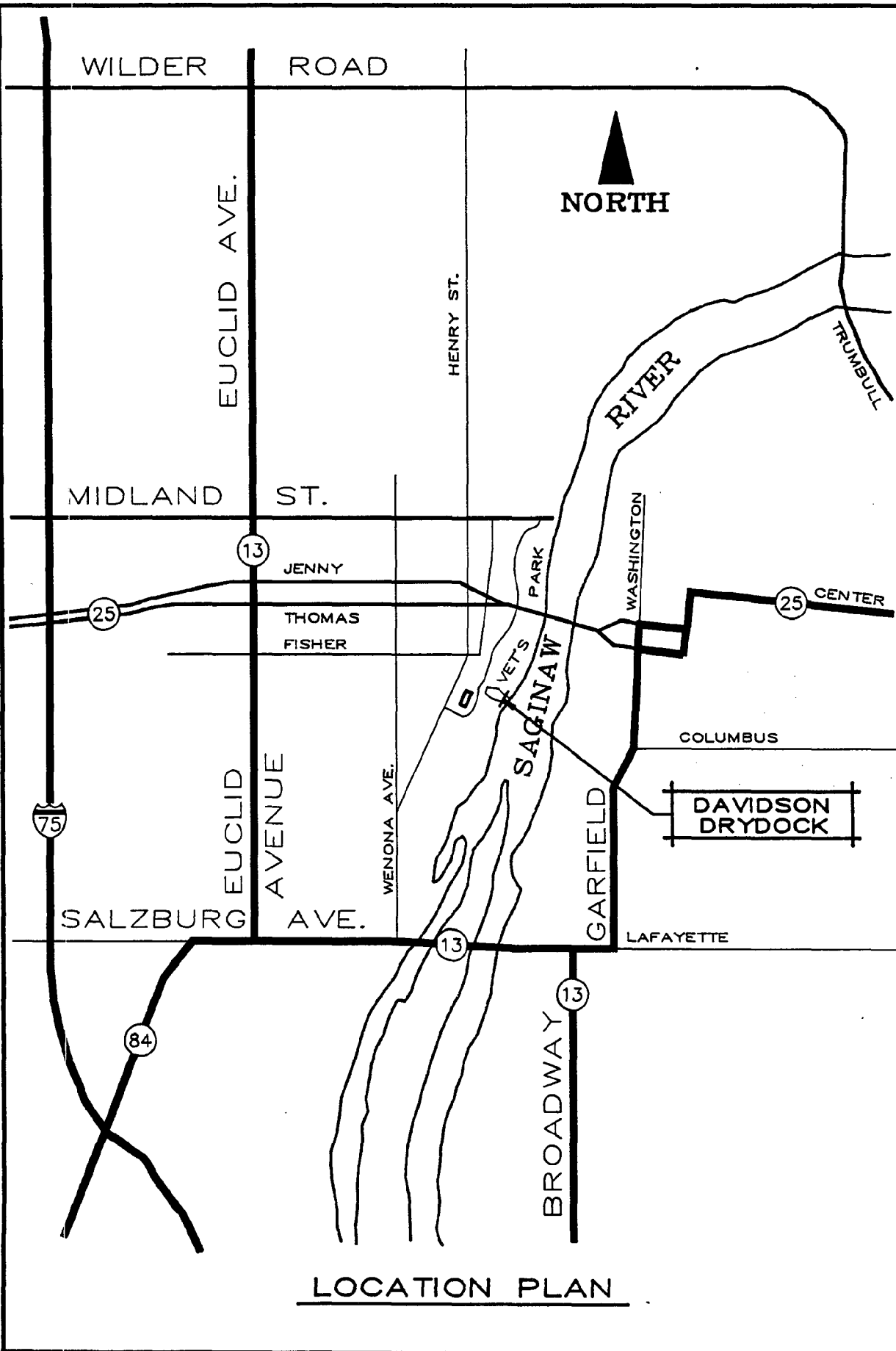
1. A concrete grade beam installed beyond the existing concrete cap, to allow backfilling of the banks to remove the uneven grade which exists.
2. A "Boardwalk" constructed over piling, with a railing along the dry dock. This would create a safe walking surface and keep pedestrians off of the concrete cap.
3. The configuration of the Boardwalk should be constructed to allow various usages, such as model boating and fishing with complete handicap access.

Cost

A general preservation scheme is presented in Exhibits #5 and #6. We have estimated the cost of this scheme to be \$ 565,000.00. A breakdown of the cost is outlined in Exhibit #7.

File: 230805.004

AUTOCAD FILE
PLOT SCALE 1"=1
DRWG. PLOTTED 09/14/92



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VETERANS MEMORIAL PARK
DAVIDSON DRYDOCK PRESERVATION

CHECKED BY	RHL
DRAWN BY	FBM
DATE	09/14/92
JOB NO.	230805
SHEET	

FIELD NOTES - UNDERWATER INSPECTION

Project: Davidson Dry Dock **Job No.:** 230805
Client: City of Bay City **Date:** 5/22/92
By: Douglas F. Reckinger, P.E.

9:30 Entered water at northwest corner adjacent to storm outlet, heading east while crossing the dry dock.
Low visibility.
Outlet 3 1/2' H x 6' W.
There is a filter on bottom of an adjacent intake pipe.
Concrete in good condition.

Vertical wood members are rotten.
Silt at the bottom is tight.
Wood terminates into silt 7' below the water surface.
Loose silt at the middle of the dry dock.

9:42 Wood pallet found.
Flat bottom occurs 4' - 5' from the edge of the dry dock (40' from west end of dry dock) approximate 7' deep.
3' silt at middle of dry dock, can't feel hard bottom.
One vertical wood section is rotted away, loose concrete behind.
Wood terminates into concrete at base.

9:58 Plank 2'x6' at bottom, parallel with wall, 6' long.
Horizontal pieces of wood connected to vertical wood, 2 - 3 planks.
Rock and gravel bottom (80' from west end of dry dock).
South side-horizontal plank at bottom.

10:11 Chain found, 2" - 3" links, attached to bottom?? Gravel/sand.
Loose pipe.
Cement chunks at bottom (100' from west end).
Pole pushed down thru silt - no bottom detected at the middle.
Rock 6' - 7' tall? No, cement broken out from wall. Lumber on side, 3' from surface.
Concrete top or curb which may have fallen in, 10' from N. wall.
Wall O.K. in area of rock
Base is 10' out. 5 horizontal members.

Vertical on top of horizontal wood (vertical wood member to the dry dock side of the horizontal member).
Horizontal members on top (horizontal wood members to the dry dock side of the vertical member).
Chain at horizontal on top of vertical.
Horizontal on both sides of vertical wood members.

10:38 Horizontal members rotted, board members, closest to surface
Rebar, 1/4 rod. Stray piece.
130' from west end. Horizontal members buried.
South side 130' out. Horizontal wood members in good shape, (6 good members).

11:00 Break

12:15 Second dive. 80' from the east end of the dry dock, there is a 1' to 2' gap between the vertical timbers and the wall. This occurs at a 60' section at the south wall, and a much longer area at the north. (Soil at the waters edge is significantly lower in these areas than at surrounding areas).

12:50 Concrete stepped retaining wall - 8' deep water.

1:05 Same concrete wall at the south regarding stepped wall.
Steps 4 fingers wide 6" - 10" high.
Vertical planks; 12' - 15' ea.
1' wide cement, another wall - 8" wide another wall - on top of wood. Stepping arrangement along the wall.

1:20 Top of gate? Huge bolts.
Laying at 35° angle pointing to the west.
Bolts leaning to west.

Bolts at 8' o.c.
Framing members at top of the gate.
Top 6 1/2' - 7' wide.
4' wall to the end of the gate.

1:55 Second dive completed.

2:50 Third dive.
Stepping at middle of wood section.
Step at west end wood area.

Scoured under concrete 50' west of steel at south wall.

South wall 10' west of decay at mid-wall (settled soil above).

3:30 Diving completed.

File: 230805.003

EXHIBIT #3

**Historical Photo
Undated
Looking Northwest**





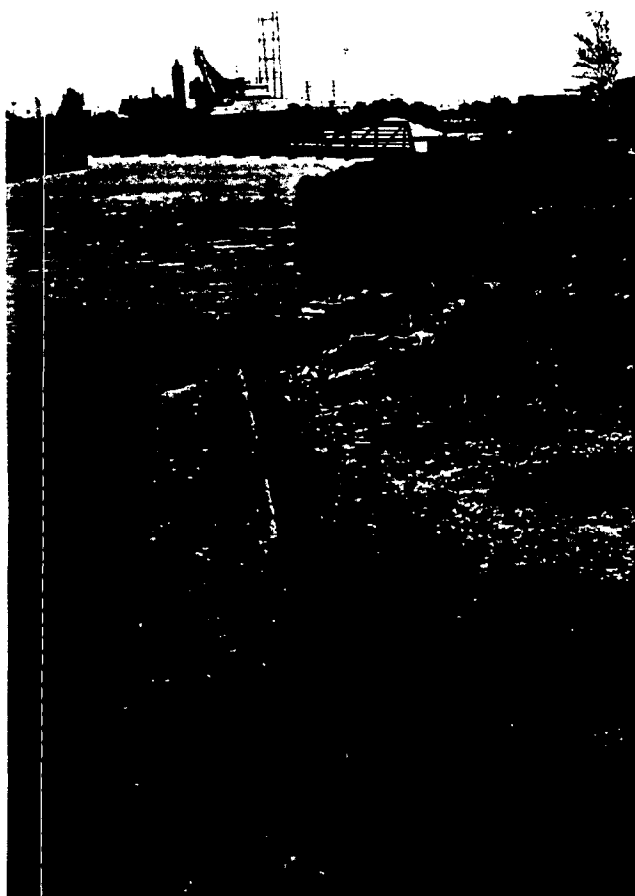
**North Bank
Looking Southwest**



**North Bank
Looking Southeast**



Concrete Cap and Deteriorated Vertical Timber, North Bank



North Bank Looking East



North Bank Looking West



South Bank
Looking South



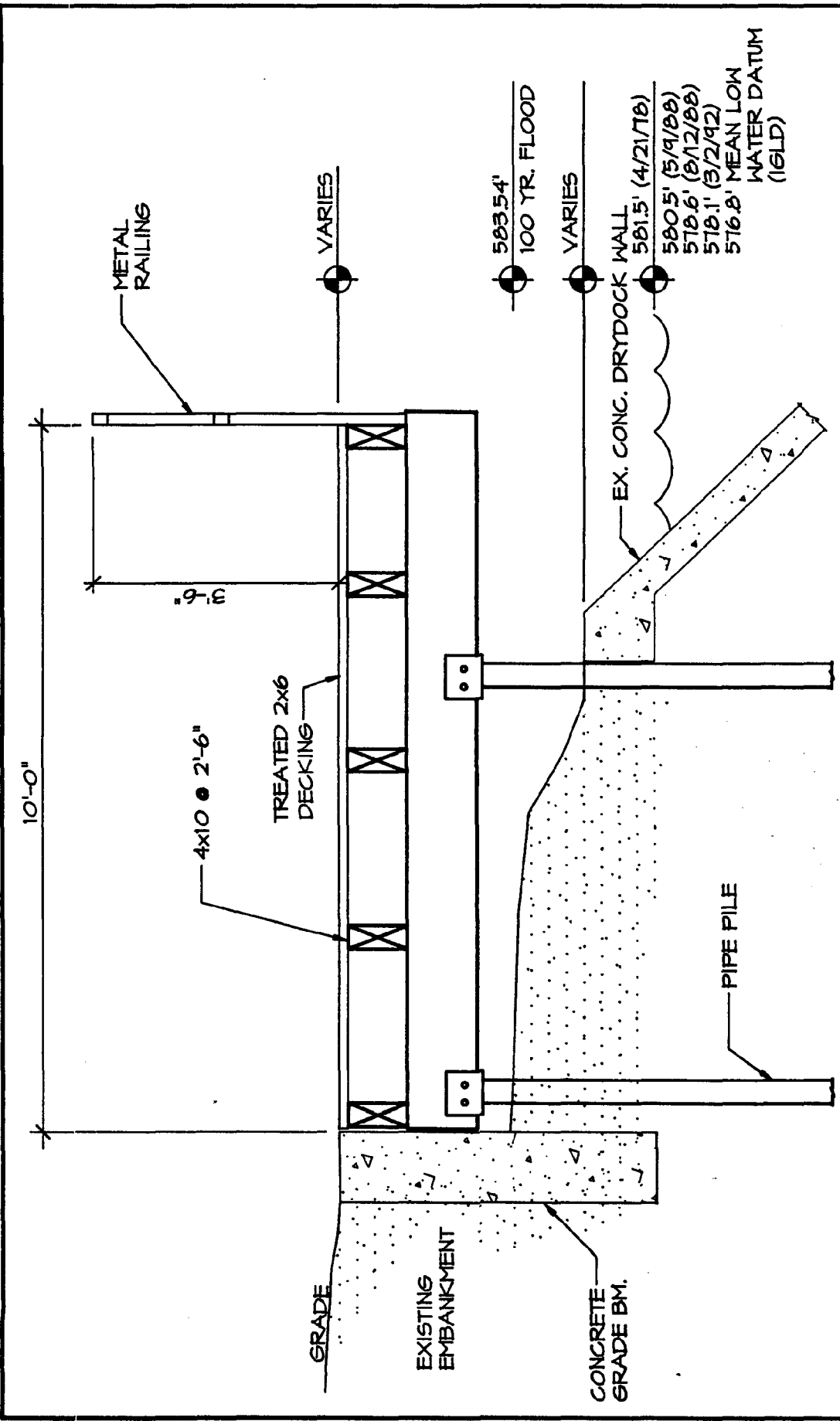
North Bank
Looking South
Deteriorated Concrete Cap



North Bank
Looking South
Deteriorated Concrete Cap

SEC 1-24
09/14/92

ALIGNED FILE
PLOT SCALE
DRWG. PLOTTED



SECTION THRU BOARDWALK
1/2" = 1'-0"

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DAVIDSON DRYDOCK PRESERYATION**

CHECKED BY	RL
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COST ESTIMATE
DAVIDSON DRY DOCK STABILIZATION
VETERANS MEMORIAL PARK

ITEM	<u>TOTAL</u>
General Conditions	\$ 40,000
New Boardwalk	
Site Preparation	30,000
Concrete Grade Beam	40,000
Pipe Piles	50,000
Walkway Deck and Handrail	165,000
Lighting	20,000
Benches and Trash Recepticals	<u>10,000</u>
	315,000
Drydock Gate	
Remove Existing Gate and Erect on New Display	20,000
Install New Gate, Abutments	<u>60,000</u>
	80,000
New Concrete Sidewalks	4,000
Miscellaneous	
Landscaping	20,000
Riprap	9,000
Sheetpiling Cap	<u>2,000</u>
	31,000
Design, Construction Engineering, Contingencies	<u>95,400</u>
Total	\$565,000

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