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TECHNICAL MEMORANDUM

To: Nicole Bures, Steelwave, LLC

From: Dilip Trivedi and Neil Nichols

Date: April 24, 2018

Subject: Alameda Shipways Project

1150 Marina Village Parkway / Alameda CA 94501

Shoreline Engineering

M&N Project No: 9696-01

Figure 1 – Shipways Aerial Image (view north)

This Technical Memorandum describes the Existing Site Conditions and Proposed Shoreline Improvements that affect the design of the foundations for the public shoreline improvements for the proposed residential development of the Alameda Shipways project site. This memo is based on a review of prior technical reports, existing drawings, visual observations of the project site, and review of available Tidal Datums.

EXISTING SITE CONDITIONS

INTRODUCTION

The 8.1 acre site is situated within the Marina Village Office Park. It is bound to the north by two City of Alameda owned parcels (APN 074-1334-68 & 69) which front the Oakland Inner Harbor water channel; to the south by Marina Village Parkway (a public road); to the east by a multi-story office building (1080 Marina Village Parkway) with a shared parking lot and marina; and to the west by a multi-story hotel (Extended Stay Hotel – 1350 Marina Village Pkwy) with a shared parking lot and marina.

Figure 2 – Project Location

EARLY SITE HISTORY (1903 – 1945)

The Shipways on the Marina Village Parkway were constructed in 1942-1943 as part of the Bethlehem Alameda Shipyard. Owned by the Bethlehem Steel Corporation, one of the largest steel manufacturers in the county, Alameda Yard was among the key shipbuilding and repair facilities of the West Coast.

The shipyard was located on land which had long been known as the Alameda Marsh. In 1903 United Engineering Co. of San Francisco purchased and improved the property and built up an extensive business in repairing and drydocking steam schooners and other ships. In 1916, the yard was purchased by Union Iron Works, a manufacturer of mining machinery, locomotives, and ships and the yard was known as the Alameda Works of Union Iron Works. In 1906, Union Iron Works was purchased by the Bethlehem Steel Corp. and in response to the World War in 1917 set up Bethlehem Shipbuilding Corp. and undertook a major expansion of their Alameda shipbuilding facilities. Their original complex spread over seventy acres and included the shipways, marine buildings for warehousing and construction of

small parts, the power house, an employee cafeteria, several office buildings, employee hospital, and a turbine machine shop. The Alameda yard was considered one of the largest and best equipped yards in the country. After 1923, the Alameda Works ceased making ships but continued its drydocking and ship repair operations but at the beginning of World War II, the Alameda Works reestablished as the Bethlehem Alameda Shipyard, Inc. and was modernized and expanded. In March 1942 the Maritime Commission requested that Bethlehem build and operate a new yard to construct ten large troop transports and the shipyard was reconditioned to handle this massive project of clearing the old buildings, and the aged facilities were redesigned and reconstructed and resumed operation in December 1942 with work continuing through 1943. “The new Bethlehem Alameda yard has four ways, arranged in two pairs. Around the ends and sides of each pair are huge preassembly and welding parks. Each pair of ways is served by three crane tracks, one in the center and one on each side, making six crane ways to serve four building ways… the ways are very solidly built of reinforced concrete, and are arranged on the inshore end into offices, store rooms, locker rooms lavatories, and specialty shops.”

RECENT SITE HISTORY (1950 – CURRENT)

After the war, the shipbuilding activities were reduced and slowly ended. By the early 1950’s the yard was used to maintain and repair equipment used by other Bay Area facilities of Bethlehem Steel. The shipyard was closed in 1956 and many of its buildings were demolished. The powerhouse and the shipways are among the remaining structures of Bethlehem Steel’s Alameda Shipways. The “Headhouses” of the shipways were rehabilitated and converted to offices in the mid-1980’s and are now designated as "Shipway #1, #2, #3 and #4."

SITE LAYOUT

The former shipbuilding site is comprised of the following components as shown in Figure 3 below:

- Four (4) pile-supported concrete headhouses currently being used as office/warehouse/store space at the landward end of each shipway;
- Four (4) pile-supported concrete shipways or ramps that slope from the roofs of the head-houses into the water;
- Six (6) pile-supported narrow concrete craneways that are level and were used to support rail-mounted cranes for shipbuilding;
- A wide pile-supported concrete welding slab between the two central craneways;
- A low-height steel sheetpile bulkhead along the east, west, and north sides (waterside edges) that retains the soil under the concrete structures.

Each of the four “shipways” slope down into the Oakland Estuary. Along both sides of each shipway are craneways. Large cranes that ran on steel tracks were used to lift materials onto the ships under construction on the shipways. Between craneways 3 and 4 is what is referred to as the “Welding Slab." This is a flat slab that was used for fitting together large welded segments of the ships that could then be lifted onto the shipways.

Figure 3 – Site Layout

CONCRETE STRUCTURES

Below the headhouses and the upper portion of the shipways, the timber piles extended some distance above the original marsh deposits and terminated in 16- to 24-inch thick concrete grade beams. Above the grade beams are concrete columns that vary in length that support the sloping 12-inch thick concrete deck slab, with a thickened slab below the center of the shipway where the ship weight was concentrated (see Figure 4).

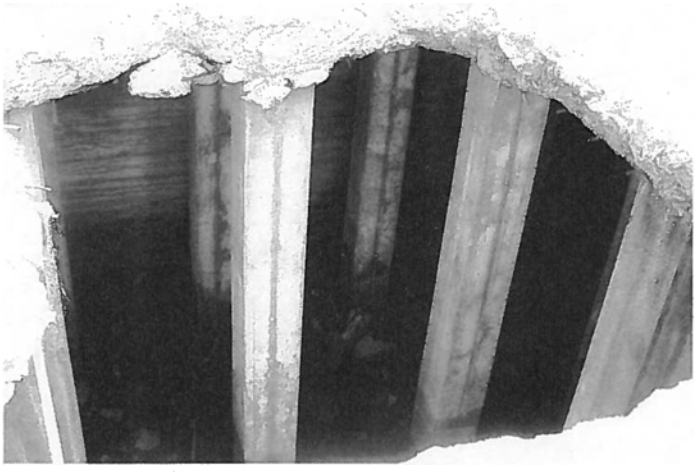

Figure 4 – View of Existing Support Structure under Shipway Slab

The shipways have a 5% slope from the landside end (roof of headhouse entrance) to the waterside end, terminating at the sheet pile bulkhead approximately 1-foot above MLLW. The headhouses – the occupied office spaces under the landside portion of the shipway -- consist of a sloping roof deck, support columns (interior and along both edges), exterior walls, and a floor slab (at craneway elevation), all supported on grade beams and timber piles. The lower portion of the shipways (nearest the channel) consist of a slab supported on grade beams and short columns where vertical clearance allows, and supported directly on piles as the slab meets the pile tops.

The craneways and welding platform consist of concrete deck slabs supported by interior and perimeter walls; with the walls supported by grade beams on piles that terminated some distance above the original marsh ground surface.

Since the deck is generally (except for the lower portions of the shipways) above the original ground surface for all the above structures, open "crawl" spaces between the deck soffit and the ground surface below exist under most of the site. Due to deterioration of the concrete structures and subsidence of the ground surface, the crawl spaces have become open to tidal action and subject the exposed untreated timber piles and the concrete structural members to deterioration in the aggressive marine environment.

The site is underlain by original marshlands that flanked the present-day Oakland Estuary. The thickness of these soft marsh deposits (Bay Mud) ranges from 50 to 80 feet[1]. Because of the poor strength of the Bay Mud, all the structures were supported on piles (untreated timber), with little fill over the original marsh deposits. There are a total of approximately 6,000 timber piles under the various deck slabs. The piles were reported to be of two vintages based on the staged development of the site - circa 1916 upon Bethlehem Shipyards acquisition of the site, and circa 1940 upon its improvement to serve the war effort.

A steel sheetpile cofferdam exists along the project site's waterside (north, east, and south) edges. The sheet pile is a heavy, ball & socket Z-shape that was commonly used at the time of construction but is not used today.

EXISTING CONDITION ASSESSMENT

Timber Piles

A large percentage of the piles are reported to have separated from the deck slab and are no longer providing support either due to marine borer attack having completely destroyed the exposed pile section or down-drag on the pile caused by the ongoing consolidation of the weak bay mud pulling the pile out of its deck connection. A study by the Forest Products Laboratory at U.C. Berkeley concluded that the primary cause was marine borer attack and that conventional pile protective wrapping systems could not be used to arrest the process in the highly vulnerable untreated timber because the systems are applicable only to the protection of preservative treated piles. The loss of pile support is likely to progress, though the portion of the piles within the soil and cut off from sea water and oxygen exchange are in relatively sound condition.

[1] Treadwell & Rollo, 2001. *Geotechnical Investigation, Shipways Office Building*, prepared for Alameda Real Estate Investments, Feb 2001, p.6

Concrete Structures

Based on visual inspection of the readily accessible portions of the structures, the structures are generally in poor condition and are not expected to meet current static or seismic loading criteria. The concrete structures show extensive cracking and spalling of the deck, perimeter walls, and support columns. The craneways show signs of moderate to severe amounts of distress and the decks have sagged in several areas. The shipways show widespread deck damage and significant cracking of the exterior walls and columns. The lower (waterside) portions are cracked and some areas show the ravages of differential settlement. A 2001 investigation of the exposed portions of the piles in the crawl space reported serious deterioration in many piles (loss of section and contact with the concrete pile caps) due to borer damage, bacteria, and fungi[2]. Piles were also found to have lost support due to settlement of the pile itself.

Figure 5 – Craneway 5 (foreground) and Craneway 6 (background).
Note: Both craneways show severe deterioration due to foundation settlement

Figure 6 – Shipway (left) and Craneway (right).
Note: Shipway columns show severe cracking.

[2] Treadwell & Rollo, 2001. *Geotechnical Investigation, Shipways Office Building*, prepared for Alameda Real Estate Investments, Feb 2001, p.10.

In the mid 1980's, numerous holes were cut through the deck of each shipway ramp and portions of the welding slab and craneways, and about 15,000 cubic yards of dredged material from nearby marinas was pumped to partially fill the crawl space between the slabs and the ground surface (see Figure 7).

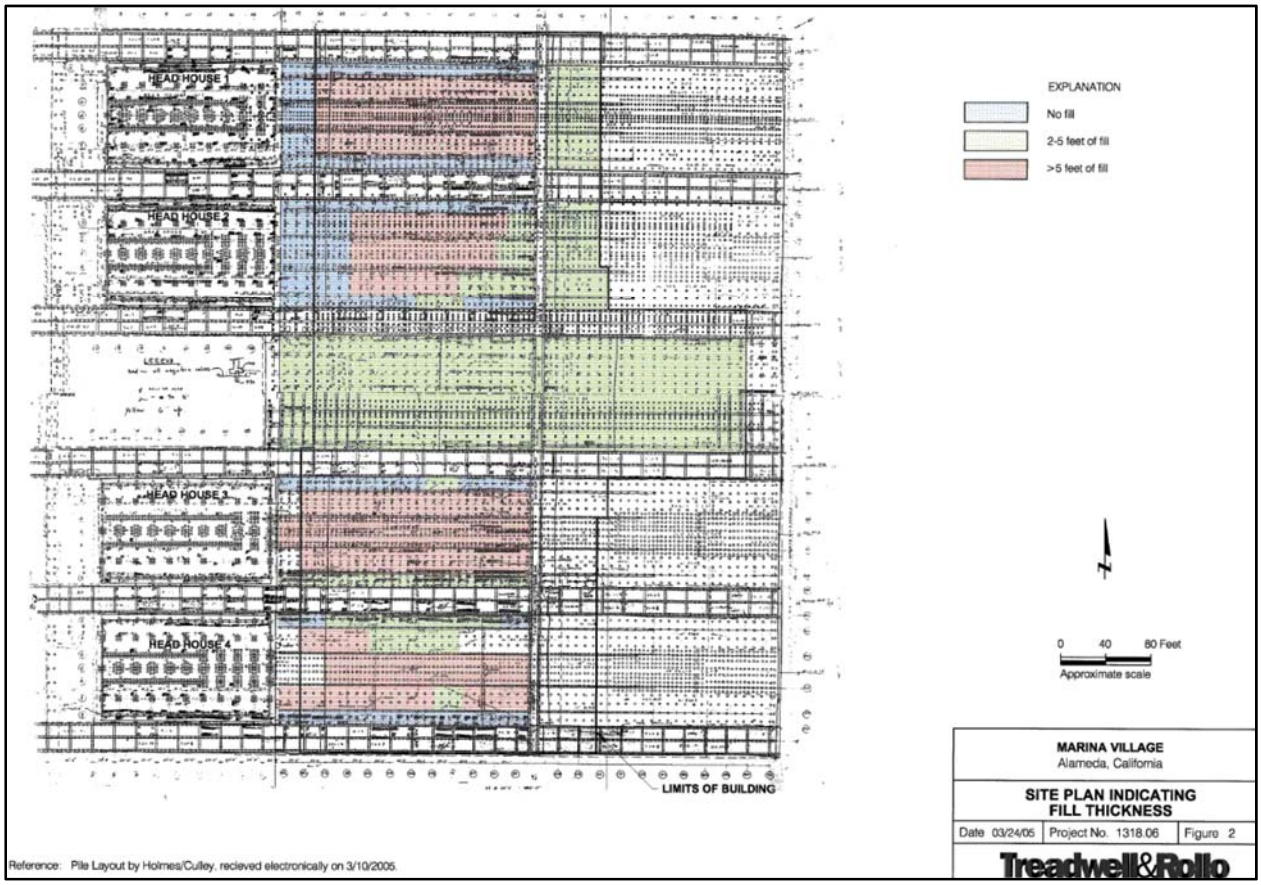

Figure 7 – Pile Layout and Fill Thickness Plan[3]

A subsequent geotechnical report notes that on-going bay mud consolidation and settlement appears to have been exacerbated by the dredge material fill due to the increased weight of the dredged material on the compressible Bay Mud. A geotechnical report in 2001 indicated that ongoing consolidation will result in future settlement of 8 to 16 inches over 50 years for the existing structures[4].

The visible portion of the site's steel sheet pile bulkhead is severely deteriorated; however the sheet pile still appears to be functioning as a soil retaining structure to hold the weak soils under the pile supported structures while providing adequate water depth for the existing marinas on either side of the site and the navigable channel to the north.

[3] Pile Layout Plan by Holmes Culley received electronically by Treadwell & Rollo on 3/10/2005. Fill thickness shown as blue = no fill; green = 2-5 feet of fill; red = greater than 5 feet of fill.

[4] Treadwell & Rollo, 2001. *Geotechnical Investigation, Shipways Office Building*, prepared for Alameda Real Estate Investments, Feb 2001, p11.

PREVIOUS REDEVELOPMENT STUDIES

Numerous developers and their consultants have investigated opportunities for redevelopment of the site and with complete unanimity have concluded that new structures should be supported on new pile foundations, which must penetrate the existing slabs if the slabs are to be left in place rather than demolished. The need for new foundations to accommodate the residential redevelopment on the site is based on the concern over the cost to both (1) extend the useful life of the seriously deteriorated existing structures and (2) retrofit them to conform to the increased loading associated with the new uses and modern codes. However the need for new foundations to accommodate the shoreline improvements, including possible restoration of portions of the existing structures for historic interpretation and public access, is still being evaluated.

PROPOSED SHORELINE IMPROVEMENTS

TIDAL DATUMS

The project will use the North American Vertical Datum of 1988 (NAVD), which is about 0.2 ft above the Mean Lower Low water (MLLW) tidal datum at the site. Data from recent tidal analysis by AECOM[5] was obtained and used to determine the tidal datum for the proposed project; see attached excerpts at the end of this memo for source data. The project location is near Point 563 from the AECOM study; corresponding tidal data is shown in the table below.

Tidal Datums for Alameda Shipways – AECOM Point 563

Datum	MLLW (ft)	NAVD [6] (ft)	Alameda City Datum (ACD) (ft)
100-yr	9.83	9.60	3.49
MHHW	6.52	6.29	0.18
ACD	6.34	6.11	0.00
MHW	**5.94**	**5.71**	**-0.40**
MSL	3.51	3.28	-2.83
MLW	1.20	0.97	-5.14
NAVD88 [2]	0.23	0.00	-6.11
MLLW	0.00	-0.11	-6.22

With regard to resource agency permit jurisdictions, the Mean High Water (MHW) elevation defines the shoreline for SF Bay Conservation and Development (BCDC) Commission "Bay" jurisdiction; its "shoreline band" jurisdiction extends 100 ft inland from the shoreline. MHW also defines the limit of SF Bay Regional Water Quality Control Board (RWQCB) jurisdiction. The 'ordinary high water', loosely defined as the highest reach of the astronomical tide during a typical year (i.e. absent rare meteorological events) is about 1-ft higher than the Mean Higher High Water (MHHW) and defines the limit of Army Corps of Engineers Section 10 permit jurisdiction. Their Section 404 jurisdiction however, extends to all waters and wetlands of the U.S. and is not limited by any tidal boundary.

The proposed shoreline finished grade (FG) elevation will be based on the 100-yr (1% annual occurrence) WSEL, plus an allowance for projected Sea Level Rise (SLR), plus and allowance for "freeboard" to further protect the shoreline improvements depending on the nature of the improvement and the degree of protection desired. For the proposed project where water access is encouraged and where wave climate is mild, an allowance of 36" for SLR (to end of century) and 24" for freeboard is appropriate. Accordingly, the recommended finished grade (FG) of the proposed Shoreline trail improvement will be 12.6' NAVD (6.5' ACD).

[5] "San Francisco Bay Tidal Datums and Extreme Tides Study, AECOM 2016
[6] Conversion from NAVD to ACD per City of Alameda published data (ACD to NGVD) and NGS (NGVD to NAVD)

Proposed Design Parameters

Datum	MLLW (ft)	NAVD [7] (ft)	Alameda City Datum (ACD) (ft)
Project Design	**12.84**	**12.61**	**6.5**
100-yr + 36" SLR	12.83	12.60	6.49
100-yr (present)	9.83	9.60	3.49
ACD	6.34	6.11	0.00
NAVD88 [10]	0.23	0.00	-6.11
MLLW	0.00	-0.11	-6.22

PROPOSED SHORELINE CONCEPT

North Side – Sloped Shoreline

The fill for the proposed shoreline trail is to be sloped no steeper than 3h:1v from the shoreline trail elevation down to the top of the bulkhead at the end of the existing concrete structures (assumed to be near MLLW). A vegetated slope is possible for this slope if articulating concrete block (ACB) mats are used, by planting the void spaces between the concrete blocks. Alternatively, armor rock could be used with a similar slope, but would not be planted.

Flatter slopes could be incorporated to eliminate the need for armor or ACB mats. At a slope of 5h:1v (or flatter) the slopes could be left earthen and planted with appropriate species for erosion control.

East and West Sides – Sheet Pile Bulkhead

The east and west sides of the property are adjacent to existing floating docks, and a steel sheetpile wall retains the fill within the project site. A new sheet pile wall, either outside of (if space permits) or inside of the existing sheet pile wall will be required to continue to retain the fill on the site and provide adequate water depth in the adjacent dock areas. The height of this bulkhead will depend on the FG of the trail and the proposed slope between the trail and the bulkhead. We recommend a sloped surface between the trail and bulkhead to minimize the size and extent of bulkhead necessary.

Water Taxi Dock

The proposed water taxi dock should be located on the channel side of the existing sheet pile bulkhead. Locating this dock within the area enclosed by the bulkhead would require extensive excavation (and demolition of sheet piles and concrete piles) and possibly the construction of a new sheetpile wall to provide adequate water depth for the docks. This should be avoided if possible to minimize environmental impacts and construction costs.

The water taxi dock will be reached via a 120-ft gangway extending from a fixed, pile-supported pier. This gangway length allows a very flat slope for improved accessibility and minimizes the length of the fixed pier. Additional flotation will be needed at the water taxi dock to support the transferred load from the gangway.

[7] Conversion from NAVD to ACD per City of Alameda published data (ACD to NGVD) and NGS (NGVD to NAVD)

POTENTIAL REUSE OF THE EXISTING SHORELINE STRUCTURES

The current shoreline redevelopment proposal requires placement of fill in place of the existing structures to create a shoreline trail/park with a soft erosion control or vegetated shoreline – as well as the previously noted pier with access to a ferry/water taxi dock. The existing structures are viewed as a liability since the cost to retrofit them to support the new loads associated with the fill and public access is estimated to exceed the cost of concrete structure removal (the untreated timber piles can be left in place to enhance the static and dynamic stability of the shoreline due to their "pinning" effect as they pose no environmental threat, and once covered with fill, will be cut off from seawater and oxygen exchange to extend their useful life indefinitely).

An alternative shoreline proposal could consider restoration of portions of the existing structures for historic interpretation based on a detailed condition investigation of the lower end of the shipways, outer end of the craneways and the welding platform that may be candidates for reuse. An early (1970's) study of site conditions had already identified serious settlement damage to Shipways 3 and 4, and Craneways 5 and 6 to preclude them from further consideration. Once the current condition of the candidate structures is understood, the portion, if any, best suited to restoration can be selected. Additional considerations that bear on the possible restoration/reuse:

- How to retrofit the structure to respond to the challenge of SLR and future WSEL. The current base (100 yr) flood level is 9.6' NAVD, or 12.6' NAVD with projected SLR to year 2100, while the elevation of the deck for the craneways/welding platform is approximately 11' NAVD, which points to a potential flooding issue since we have not included an allowance for freeboard or the ongoing structure subsidence.
- How to retrofit the structure to respond to increased loading, particularly seismic, associated with the new use and codes, including whether or not to allow public access on the restored structure.
- Shoreline appearance with the restored remnants, and whether the interpretive mission for the historic use can be better met in some other way.
- The affordability of the costs that must be passed on to the development's future residents.

SUMMARY

Given the above findings, we recommend against using the existing shipyard structures as foundation support for the residential structures in the proposed redevelopment. Portions of the existing structures are over 100 years old and the nature and extent of the documented deterioration indicate that the structures are beyond economic rehabilitation. The specific deficiencies of the existing structures include:

- Structurally deteriorated concrete (extensive concrete distress and rebar corrosion)
- Concrete structures that do not meet current seismic code requirements for the new uses
- High percentage of timber piles that are not in contact with the concrete slabs they support
- Deterioration of the untreated timber piles
- Ongoing settlement of the structure

A similar recommendation applies to the redevelopment of the public shoreline trail/park as proposed.

Retaining portions of the original concrete structures (shipways, craneways, and welding platform) for their interpretive value within the public shoreline trail/park as part of the proposed redevelopment may be considered. The feasibility of such reuse will depend on further investigation, to include:

1) Detailed condition evaluation of portions of the structures that are candidate for restoration;
2) Planning studies of the appropriate interpretive use, and the whether or not public access will be provided on the restored structures;
3) Engineering studies of restoration/retrofit options to provide flood protection and static/seismic stability;
4) Cost Feasibility to restore/retrofit the structures.