Attachment 14
Bulk Material Tank Systems
Table of Contents

List of Tables

List of Figures

List of Appendices

D.2 Tank Systems

This Section provides information for the RCRA Wastewater Tank storage systems and the Mixing Tanks:

The RCRA Wastewater Tank System consists of: Tank #1, #2, #3 and #4.

Specific waste types and codes that could be managed in these above ground tank systems include but are not limited to potential remedial or corrective measures, potential spill response activities, F039 leachate or other liquids listed in USEI's Part A. The location of these tanks is shown on the Facility Site Plan (Figure D-1).

These tanks were designed, constructed, and operated to meet the requirements of 40 CFR Part 264, Subpart J. The facility does not manage wastes subject to the requirements of 40 CFR Part 264, Subpart CC in these tanks. As such, these tanks were not designed or constructed to meet the standards of 40 CFR §§264.200 and 264.1084 for management of tanks requiring Level 1 controls.

The two (2) Mixing Tanks are located in the Indoor Stabilization Building. The units are constructed and maintained to comply with the requirements of 40 CFR Part 264, Subpart J. Details regarding the Indoor Stabilization Building and the Mixing Tanks are also found in Section D.9.

Specific waste codes that could be managed in these tank systems are highly varied and include liquid and solid wastes as listed in USEI's Part A. The location of the Indoor Stabilization Building Mixing Tanks is shown on Drawing #STAB-19-01.

These tanks are designed, constructed, and operated to meet the requirements of 40 CFR Part 264, Subpart J. The facility does not manage wastes subject to the requirements of 40 CFR Part 264, Subpart CC in these tanks.

Certifications of USEI's RCRA tank systems that were performed by an independent, qualified registered engineer are provided in Appendix D.2.2. Additional certification for the Indoor Stabilization Building Mixing Tanks will be provided with the CQA report for the building, once construction is complete.

D.2.a Tank System Description

D.2.a.(1) Wastewater Tank System

Four (4) above ground tanks are used for storage and treatment of RCRA hazardous wastes and are designated as Tanks #1, #2, #3 & #4. They are located adjacent to the southeast corner of CSP #4 as shown on Drawing # PRMI-R11, PRMI-C11, -C12, and -C13. Tank Certifications and associated construction dates are provided in Appendix D.2.2. The typical dimension of each Wastewater Tank is 12 ft. in diameter and 20 ft. in height with a capacity of approximately 16,930 gallons each.

The four (4) tanks are constructed of welded carbon steel and the physical characteristics of these tanks are listed in Table D-2. Tanks are constructed of ⅜ in. carbon steel/A36 plate, and conform to the specifications and requirements of the American Petroleum Institute (API) Standard 650. API 650, Appendix A was used in conjunction with measured shell thickness and fluid properties to determine the maximum specific gravity each tank can safely hold. Appendix D.2.1 contains the results of the most recent certified thickness measurements.

All four tanks are vertical, shell-mounted, uniformly structurally supported and anchored on concrete foundations satisfying the requirements of the American Concrete Institute Building Code 318 (ACI 318)

and the on-site soil bearing pressures. Tanks are equipped with a manway, a conservation breather vent, a liquid level indicator, inlet and outlet valves, and spare valves. Each tank is equipped with a cover (a fixed roof) vented through a closed system to a control device (carbon adsorption canister) to remove volatile organic vapors and are insulated for freeze protection. The vessel design data sheets for these tanks are shown in Figures D-3 to D-6.

The flow diagram shown on Drawing # 720C-P02, illustrates how they are integrated into the facility's RCRA operations and provide instrumentation details for each tank. Drawing # 720C-P01 provides this information on the leachate piping and Appendix D.2.4 provides the specifications for the leachate piping. The tanks are operated under ambient temperature and pressure conditions and are heat traced to prevent freezing in the winter.

All equipment (i.e., pumps, etc.) ancillary to the tanks are anchored, where necessary, in accordance with the manufacturer's recommendations. Drawing # 720C-G01, -G02, -G03, -G04, -G05, -G06 and -G07 show the tank system, including the piping from landfill Cell 14 and 15 to the tanks, from the tanks to Collection Pond 3, and continuing to the Evaporation Pond. The piping consists of butt welded HDPE pipe (SDR-11, 160 psi) which has been placed above ground surface to facilitate regular inspection. The specification for this piping is included in Appendix D.2.4. The pipes are placed and the leachate piping system is operated such that it is essentially empty when not in use and pipe freezing is not a concern. Pipe culverts have been constructed at all road crossings to protect the pipes from vehicle traffic. The leachate piping system for Cell 16 is discussed and illustrated in Appendix D.5.1.

Ignitable, reactive, or incompatible (in separate tanks, only) wastes may be stored in the tanks in accordance with IDAPA 58.01.05.008 [40 CFR 264.198, 264.199, and 264.200]. Procedures for safely managing ignitable, reactive, or incompatible wastes are described in Section F.

D.2.a.(2) Indoor Stabilization Building Mixing Tanks

The Indoor Stabilization Building will house the two (2) Mixing Tanks, and is to be constructed in 2020. The Indoor Stabilization Building will be located adjacent to the west wall of Container Storage Pad 8 (CSP #8) as shown on the Facility Site Plan, Figure D-1. The Indoor Stabilization Building consists of a steel framed building supported by concrete spread footings. The units' walls and roof are insulated metal panels. The floor consists of a reinforced concrete slab with perimeter curbs. The Mixing Tanks consist of a reinforced concrete vault with a steel plate liner. The steel plate liner serves as the primary containment and is welded at all seams to form a water tight seal. The steel plates are exposed to abrasion and mixing forces during the mixing of wastes, which is performed with an excavator. When the steel plates exhibit excessive wear, then additional steel plates will be installed, as needed, to maintain primary containment.

The reinforced concrete vault serves as the secondary containment. The 12-inch thick concrete vault is reinforced with steel rebar to provide structural strength and is amended with Xypex (or equivalent) additive to retard concrete permeability. Water stop features will be installed along all cold joints, located inside of the vaults, to preclude leakage through the construction joints, in accordance with 40 CFR 264.193(e)(2).

An annulus space is provided between the primary containment and the secondary containment to allow for leak detection monitoring behind the primary containment. The depth of the annulus space varies from about 2 to 5 inches and is accessed via a 4-inch diameter inspection port that will be utilized to inspect for leakage and removal of any liquids that accumulate inside the leak detection annulus.

Additional detailed information concerning the Indoor Stabilization Building and the MixingTanks is found in Section D.9. This system is designed to manage both solid and liquid type waste streams that require treatment prior to landfill disposal.

The Mixing Tanks will be founded on controlled structural fill, located approximately 13 feet below the finished grade, that is capable of providing a minimum bearing capacity of 3,000 psf. Controlled structural fill will also be placed around the exterior perimeter of each Mixing Tank concrete vault and will provide adequate passive resistance, in excess of the static loads imposed by the contained waste materials, plus the dynamic forces imposed by the excavator bucket. The Mixing Tanks will be placed on and in structural fill materials designed to withstand pressure gradients to the sides, above and below the system as well as capable of preventing failure due to settlement, compression, or uplift and therefore meet the requirements of 40 CFR 264.193(c). Design calculations are found in Appendix D.2.6.

Ignitable, reactive, or incompatible wastes may be managed in the tanks in accordance with IDAPA 58.01.05.008 [40 CFR 264.198, 264.199, and 264.200]. Procedures for safely managing ignitable, reactive, or incompatible wastes are described in Section F.

The concrete vault (secondary containment) associated with each Mixing Tank has a rectangular shape with plan view dimensions of approximately 15 ft. by 20 ft. and a depth of 13 feet. The steel lined portion of each tank (primary containment) is approximately 5 to 8 inches narrower in plan view dimensions and about 3 inches shallower. The effective containment capacity of each primary containment vessel is 120 CYD or 24,200 gallons.

D.2.b Existing Tank Systems

D.2.b.(1) RCRA Storage Tanks Integrity Assessments

The secondary containment systems for the tanks meet the requirements of 40 CFR 264.193 and, as such, are not subject to the requirements of 40 CFR 264.191.

If visual inspections of the tanks and structures show signs of failure (e.g., a crack or leak), then the tank's contents will be drawn down, as necessary, and transferred into another tank or managed in another appropriate way, and the required repairs or replacement will be implemented in accordance with 40 CFR 264.196.

The tanks are used for storage of wastes that are compatible with each tank's construction materials and corresponding pipelines, gaskets, and pumps. Waste/tank compatibilities are determined by the waste material's chemical characteristics, the construction of the tank, and the known corrosion resistance properties of the tank or the selected protection system (lining, coating, etc.). Table D.2.3.1 of Appendix D.2.3 lists the general compatibility of the various materials of construction versus the waste chemical compatibility groups to be stored in the tanks. The tanks are constructed of carbon steel and do not have a lining or coating associated with them. Reference corrosion rates are given in Appendix D.2.3. Wastes which are incompatible with the Materials of Construction (MOC) will not be placed or stored within the tanks. The aqueous F039 wastes, purge water from groundwater sampling, and precipitation from treatment areas that these tanks usually hold are neutral in character.

Thickness measurements for the tank systems are performed every three years to assess the structural integrity and suitability of the Wastewater tank system for handling hazardous waste. Copies of the Engineering Certification reports are included in Appendix D.2.1. Ongoing inspection requirements and the associated schedule are provided in Section F, Table F-1 of this Permit Application.

D.2.b(2) Stabilization Building Mixing Tanks Integrity Assessments

The secondary containment systems for the tanks meet the requirements of 40 CFR 264.193 and, as such, are not subject to the requirements of 40 CFR 264.191.

If inspections of the tanks indicate signs of failure (e.g., leak), then the tank will be emptied, as necessary, and the required repairs will be implemented in accordance with 40 CFR 264.196.

The tanks are used for storage and treatment of wastes that are compatible with each tank's construction materials.

Construction of the the Mixing Tanks will be certified by an independent, qualified registered professional engineer in accordance with 40 CFR 264.192(a) and/or 270.16. A copy of the certification report will be included in Appendix D.9.1.

Daily tank inspections will also be performed during tank operation, as outlined in Section F.

D.2.b.(3) Wastewater Tanks External Corrosion Protection

The requirement for external corrosion protection applies to tank systems without secondary containment meeting the requirements of 40 CFR 264.193 and to new metal tank systems or components that are in contact with the soil or water in the environment (40 CFR 264.192(a)(3)). As such, this requirement does not apply to any of the tanks. However, the insulation and stainless steel jacketing do protect the exteriors of the Wastewater tanks from corrosion as the tank exteriors are not exposed.

D.2.b.(4) Stabilization Building Mixing Tanks External Corrosion Protection

Because there are no external shells made of metal, the requirements for corrosion protection are not applicable (40 CFR 264.192(a)(3)).

D.2.c New Tank Systems

D.2.c.(1) Integrity Assessments

If an existing tank is replaced the new tank(s) will conform to the requirement of integrity assessments of 40 CFR 264.192, Design and installation of new tank systems or components.

D.2.d Containment and Detection of Releases

D.2.d.(1) Wastewater Tanks Secondary Containment System Design, Construction and Operation

As shown on Drawing #'s PRMI-R11 and -C11, Tanks #1 & #4 share a common secondary containment area as do Tanks #2 & #3. The secondary containment systems were designed and installed to completely surround the tanks and to cover all surrounding soils likely to come in contact with any wastes released from the tanks. Both secondary containment areas meet the requirements of 40 CFR §264.193 and consist of sealed concrete pads and dikes. As such, the secondary containment systems are capable of preventing releases to underlying and surrounding soils. The sealant applied to the concrete is compatible with all wastes anticipated to be stored. The current sealant's waste compatibility is contained in Appendix D.1.2, however equivalent or superior sealants may be utilized.

The concrete walls of the secondary containment system are one ft. thick and four ft. high. The system has more than sufficient strength and thickness to prevent failure caused by any pressure gradients (i.e., static head of rainwater and/or waste), climatic conditions, and the stress of daily operations. Because of the sealant, the concrete will also resist degradation by physical contact with wastes and precipitation.

The concrete foundation of the secondary containment systems is capable of providing support, resisting pressure gradients above and below the system, and preventing failure from settlement, compression or uplift. Drawing # PRMI-R11, -C11, -C12 and -C13 show the structural support for the tanks.

The containment systems for these tanks are open, above-grade, and readily inspected for cracks or gaps and system integrity or for evidence of leaks or spills from the tanks. Any leaks or spills from the tanks are promptly identified because the tanks and secondary containment systems are inspected daily when in use in accordance with Section F.2.b.(2) of Section F, Procedures to Prevent Hazards.

As demonstrated by the tank system secondary containment volume calculations in Appendix D.2.7, each of the secondary containment systems has the capacity to contain the greater of 10% of the total volume of all tanks within the containment area, or 100% of the capacity of the largest tank plus the rainfall from a 25-year, 24-hour rainfall event. Both containment areas are sloped to a low point to facilitate collection and removal of rainwater and leaked/spilled liquids. Because the tanks and secondary containment system walls are located above ground, run-on and infiltration of precipitation into the secondary containment systems is prevented.

Ancillary equipment, such as pumps and pipeline systems serving these tanks, are also located above ground and subject to daily visual inspection when in use in accordance with Section F. With the exception of the leachate piping, all existing ancillary equipment has secondary containment meeting the requirements of 40 CFR 264.193(b) and (c) as shown on Drawing #'s 720C-G01, -G02, -G03, and -G04. However, all leachate piping and other ancillary equipment (i.e., joints, connections, pumps and automatic shut-off devices) are inspected daily when in use to transfer waste material (40 CFR 264.193(f)).

D.2.d.(1)(a) Requirements for Tank Systems Until Secondary Containment is Implemented

As the four Wastewater treatment tanks have secondary containment systems meeting the requirements of 40 CFR 264.193, these requirements are not applicable.

D.2.d.(1)(b) Variance from Secondary Containment Requirements

As the four (4) Wastewater Treatment tanks have secondary containment systems meeting the requirements of 40 CFR 264.193, a variance from the secondary containment requirements is not requested.

D.2.d.(1)(c) Controls and Practices to Prevent Spills and Overflows

The general procedures for operating the Wastewater Treatment tanks are as follows:

- The tanks and waste material are compatible, and the tanks are not used for mixing of incompatible wastes, unless the provisions of 40 CFR 264.177 are met.
- Records for each tank are maintained which describe the contents or previous contents by waste type or name and date of waste placement/removal.
- Upon entering the facility, prior to unloading, the transportation vehicles containing waste materials are reviewed according to the procedures in the WAP. A compatibility test may, if necessary, be conducted to verify the waste's compatibility with the contents in an individual tank.

- At the unloading station, the liquid waste transport vehicles are placed within a contained area, or all connections will have drip pans placed beneath them and facility personnel wearing proper PPE make all necessary connections.
- Prior to waste transfer, facility personnel inspect all connections and overfill controls and verify that the waste is being transferred to the proper tank. The tank receiving the waste is checked to verify it has sufficient capacity to accommodate all of the waste to be transferred and facility personnel monitor transfer operations.
- Upon completion of waste transfer, the valves are closed and all hoses are disconnected.
- The tank area operators complete a daily tank inventory control log (an example is shown in Figure D-7) for each tank detailing the type and volume of waste received and placed into storage.
- Removal of liquid hazardous wastes from tanks follows the same procedures as loading.
- Each tank area is inspected per Section F. Any item checked as unacceptable is immediately investigated, and any required remedial action is promptly initiated.

D.2.d.(1)(d) Response to Leaks or Spills

Response procedures for significant leaks or spills from the Wastewater Tanks are described in the Contingency Plan. As required under 40 CFR 264.196(f), following any extensive repairs to a RCRA tank system, the tank system will not be returned to service until the repaired system is certified by an independent, qualified, registered, professional engineer. This certification will be submitted to the IDEQ within seven (7) days after returning the tank system to use.

D.2.d.(1)(e) Air Emission Standards

Based on the types of equipment and operations at the facility, Subparts AA and BB of 40 CFR Part 264 are not applicable to the facility. In addition, the facility does not currently manage any wastes subject to the requirements of 40 CFR Part 264, Subpart CC in tanks. As such, these regulations do not apply to the facility's tanks.

D.2.d.(2) Stabilization Building Mixing Tank Secondary Containment System Design, Construction and Operation

Details regarding the design and operation of the Mixing Tank secondary containment systems are provided in Section D.9.

D.2.d.(2)(a) Requirements for Tank Systems Until Secondary Containment is Implemented

As the Mixing Tanks will have secondary containment systems meeting the requirements of 40 CFR 264.193, these requirements are not applicable.

D.2.d.(2)(b) Variance from Secondary Containment Requirements

As the Mixing Tanks will have secondary containment systems meeting the requirements of 40 CFR 264.193, these requirements are not applicable.

D.2.d.(2)(c) Controls and Practices to Prevent Spills and Overflows

The general procedures for operating the Mixing Tanks are as follows:

- The Mixing Tanks and waste material are compatible, and the tanks are not used for mixing of incompatible wastes, unless the provisions of 40 CFR 264.199 are met.
- Records for each batch are maintained which describe the contents or previous contents by waste type or name and date of waste treatment.
- Upon entering the facility, prior to unloading, the transportation vehicles containing waste materials are reviewed according to the procedures in the WAP. A compatibility test may, if necessary, be conducted to verify the waste's compatibility with the contents in an individual tank.
- At the unloading location, the offloading portion of waste transport vehicles are placed within the containment area of the Indoor Stabilization Building.
- The Mixing Tank receiving the waste is checked to verify it has sufficient capacity to accommodate all of the waste to be transferred and facility personnel monitor transfer operations.
- Each Mixing Tank and area is inspected per Section F. Any item checked as unacceptable is immediately investigated, and any required remedial action is promptly initiated.

D.2.d.(2)(d) Response to Leaks or Spills

The leak detection annulus is monitored daily using the 4-inch diameter Inspection Port (see Drawing STAB-19-12), as described in Section F. If liquids are found within the secondary system they are removed as soon as possible or within 24 hours of a detection of any pumpable liquids (pumpable level by vacuum truck).

Spills that occur while loading waste into the Mixing Tanks are managed as soon as possible. Due to the recessed floor design inside of the Indoor Stabilization Building, leaks and spills can be easily controlled by use of appropriate equipment (e.g. shovels, front-end loaders etc.).

D.2.d.(2)(e) Leak Detection

Details of the Mixing Tank leak detection annulus (secondary containment) is described in the section above and in Section D.9.

D.2.d.(2)(f) Air Emission Standards

Based on the types of equipment and operations at the facility, Subparts AA and BB of 40 CFR Part 264 are not applicable to the facility. In addition, the facility does not currently manage any wastes subject to the requirements of 40 CFR Part 264, Subpart CC in tanks. As such, these regulations do not apply to the facility's tanks. In order to manage air borne particulates the following APC equipment has been installed in the Indoor Stabilization Building:

- Mixing Tanks - Each Tank is equipped with retractable vinyl curtains and overhead hoods to collect airborne particulates. A water spray system is also established for controlling dust that may be generated when off-loading waste into the Mixing Tanks or during stabilization mixing activities.
- General Ventilation - The building has two (2) general ventilation intakes that route to exterior baghouse units to maintain air quality in the building.

Drawing #'s STAB-19-03 and -04 show the locations of all the dust collection hoods and intakes inside the Stabilization Building.

Table D-2 – Physical Characteristics of USEI RCRA Waste Water Tanks

Physical Characteristics of USEI RCRA Waste Water Tanks				
Typical Use Waste/Process	**RCRA Tank No.**	**Diameter (ft)**	**Health or Length (ft)**	**Capacity (gal)**
General aqueous wastes (organic and inorganic	T-1	12	20	16,930
General aqueous wastes (organic and inorganic	T-2	12	20	16,930
General aqueous wastes (organic and inorganic	T-3	12	20	16,930
General aqueous wastes (organic and inorganic	T-4	12	20	16,930

RCRA Mix Tanks					
Typical Use Waste/Process[1]	**Mixing Tank No.**	**Depth**	**Width**	**Length**	**Capacity (gallons)**
Part A Solid Wastes, Part A aqueous wastes (organic and inorganic), Part A Hazardous Debris	MT No.1	12.75 ft.	15	20	24,200
Part A Solid Wastes, Part A aqueous wastes (organic and inorganic), Part A Hazardous Debris	MT No. 2	12.75	15	20	24,200

[1] Wastes over 500 ppm VOC are subject to 40 CFR 264.1080 Subpart CC

Figure D-3 - Vessel Data Sheet for RCRA Tank No. 1

Figure D-3 Vessel Data Sheet for RCRA Tank No. 1						
1.	PROJECT NO. ITEM NO. T–1 SPEC. NO.					
2.	CLIENT: US ECOLOGY IDAHO, INC. INQ./ REQ. NO.					
3.	LOCATION GRAND VIEW, IDAHO NO. REQUIRED ONE (1)					
4.	SERVICE OF UNIT WASTE PREPARED BY DATE					
5.	REV. A BY O. Todd DATE 19 Mar 87					
6.	PROCESS CONDITIONS					
7.	CONTENTS (MAT'L): WASTE					
8.	SP.GR : < 1.65 BULK DENSITY : < 103 LBS/ FT^3					
9.	NORM. PRESS. < 0.5 PSIG. TEMP 70 BF					
10.	CONTRUCTION DETAILS					
11.	MIN. DESIGN PRESSURE : 0 PSIG					
12.	MIN. DESIGN TEMPERATURE : -15 B F MAX 150B F					
13.	MATERIAL: A36 STL VOLUME 15,000 GAL					
14.	INSTALLATION : (OUTDOOR)					
15.	WIND LOAD DESIGN: SEISMIC ZONE : 1					
16.	DESIGN CODE: UL-142 ANGLE OF RESPONSE: N.A					
17.	ANGLE OF FRICTION AGAINST SIDE WALLS: N. A.					
18.	VERTICAL					
19.	ELEVATION ABOVE GRADE 20 FT 0 IN.					
20.	CONNECTIONS					
21	MARK	SERVICE	NO.REQ	SIZE	RATING	FACING
22.	A	FILL	1	3"	150#	RF
23.	B	RECIR	1	3"	150	RF
24.	CONSERVATION VENT & FLAME ARRESTOR					
25.	C		1	3"	150	RF
26.	D	SPARE	1	3"	150	RF
27.	E	MANWAY	1	16"	ASA	FLG
28.	& PRESS.REL. COVER VENT					
29.	F	MANHOLE & COVER	1	24"	API	FLG
30.	G	SUCTION	1	4"	150	RF
31.	H	SPARE	1	2"	150	RF
32.	J	LEVEL	1	4"	150	RF
33.	K	LEVEL	1	4"	150	RF
34.						
35.	REMARKS:					
	PROVIDE DROP TUBE TO WITHIN 6" OF BOTTOM ON (A& B).					
	DROP (G) TO WITHIN 6" OF BOTTOM.					
	PAINT W/ONE (1) COAT R.L. PRIMER & TWO (2) COATS LIGHT GRAY ENAMEL.					

Figure D-4 - Vessel Data Sheet for RCRA Tank No. 2

Figure D-4 Vessel Data Sheet for RCRA Tank No. 2						
1.	PROJECT NO. ITEM NO. T–2 SPEC. NO.					
2.	CLIENT: US ECOLOGY IDAHO, INC. INQ./ REQ. NO.					
3.	LOCATION GRAND VIEW, IDAHO NO. REQUIRED ONE (1)					
4.	SERVICE OF UNIT WASTE PREPARED BY DATE					
5.	REV. A BY O. Todd DATE 19 Mar 87					
6.	PROCESS CONDITIONS					
7.	CONTENTS (MAT'L): WASTE					
8.	SP.GR : < 2.0 BULK DENSITY : < 125 LBS/ FT^3					
9.	NORM. PRESS. < 0.5 PSIG. TEMP 70 BF					
10.	CONTRUCTION DETAILS					
11.	MIN. DESIGN PRESSURE : 0 PSIG					
12.	MIN. DESIGN TEMPERATURE : -15 B F MAX 150B F					
13.	MATERIAL: A36 STL VOLUME 15,000 GAL					
14.	INSTALLATION : (OUTDOOR)					
15.	WIND LOAD DESIGN: SEISMIC ZONE : 1					
16.	DESIGN CODE: UL-142 ANGLE OF RESPONSE: N. A					
17.	ANGLE OF FRICTION AGAINST SIDE WALLS: N. A.					
18.	VERTICAL					
19.	ELEVATION ABOVE GRADE 20 FT 0 IN.					
20.	CONNECTIONS					
21	MARK	SERVICE	NO.REQ	SIZE	RATING	FACING
22.	A	FILL	1	3"	150#	RF
23.	B	RECIR	1	3"	150	RF
24.	CONSERVATION VENT & FLAME ARRESTOR					
25.	C		1	3"	150	RF
26.	D	SPARE	1	3"	150	RF
27.	E	MANWAY	1	16"	ASA	FLG
28.	& PRESS.REL. COVER VENT					
29.	F	MANHOLE & COVER	1	24"	API	FLG
30.	G	SUCTION	1	4"	150	RF
31.	H	SPARE	1	2"	150	RF
32.	J	LEVEL	1	4"	150	RF
33.	K	LEVEL	1	4"	150	RF
34.						
35.	REMARKS:					
	PROVIDE DROP TUBE TO WITHIN 6" OF BOTTOM ON (A& B). DROP (G) TO WITHIN 6" OF BOTTOM. PAINT W/ONE (1) COAT R.L. PRIMER & TWO (2) COATS LIGHT GRAY ENAMEL.					

Figure D-5 - Vessel Data Sheet for RCRA Tank No. 3

Figure D-5 Vessel Data Sheet for RCRA Tank No. 3			
1.	CONTRACT NO. 8101 ITEM NO. T–3 SPEC. NO. API-650/UL-142		
2.	CLIENT: US ECOLOGY IDAHO, INC. REQ. NO.		
3.	LOCATION: GRAND VIEW, IDAHO NO. REQUIRED ONE (1)		
4.	UNIT OR AREA: LEACHATE TREATMENT, RCRA BY: J. BRENNAN DATE: 22 July 91		
5.	REV. B BY: M. WELSH DATE 19 November 91		
6.	VESSEL SERVICE: TREATED H2O STORAGE		
7.	PROCESS CONDITIONS		
8.	VESSEL FLUID H2O WATER		
9.	SPECIFIC GRAVITY G T 60 < 2.0		
10.	NORMAL PRESSURE PSIG < 0.5		
11.	NORMAL TEMPERATURE ^{0}F 70		
12.	CONSTRUCTION DETAILS		
13.	MINIMUM DESIGN PRESSURE PSIG 0		
14.	MINIMUM DESIGN TEMPERATURE ^{0}F -15^0 /+ 115^0		
15.	MATERIAL A 36 CARBON STEEL		
16.	VOLUME USG 15,000 (NOMINAL)		
17.	INSULATION OUTDOOR CODE UL-142		
18.	VERTICAL OR HORIZONTAL: VERTICAL		
19.	ELEVATION ABOVE GRADE FT. 20’ – 0”		
20.	CONNECTIONS		
22.	#1	24” 0	MANWAY W/O COVER
23.	#2	24” 0	MANWAY W/COVER GASKET
24.	#3	1$^{1/4}$” 0	LVL. BRD. CPL’G
25.	#4	20’	LVL. BRO. ASSY.
26.	#5	3” 0	FLG’D IN/OUTLET W/BLIND FLG
27.	#6	4” 0	FLG’D IN/OUTLET W/BLIND FLG
28.	#7	3” 0	FLG’D W/DIP TUBE TO WITHIN 6’ OF TANK BOTTOM, W/BLIND FLG
29.	#8	4” 0	FLG’D IN/OUTLET W/BLIND FLG
REMARKS: 12’ 0 X 20’ H, FLAT TOP NOTE: FAB/SHIP LOOSE (1) LADDER/CAGE ASSY. (2) (1) HANDRAIL W/KICKPLATE REV B AS-BUILT DETAILS OF CONNECTIONS			

Figure D-6 - Vessel Data Sheet for RCRA Tank No. 4

Figure D-6 Vessel Data Sheet for RCRA Tank No. 4						
1.	PROJECT NO. ITEM NO. T–4 SPEC. NO.					
2.	CLINT US ECOLOGY IDAHO, INC. INQ./ REQ. NO.					
3.	LOCATION GRAND VIEW, IDAHO NO. REQUIRED ONE (1)					
4.	SERVICE OF UNIT WASTE PREPARED BY DATE					
5.	REV. A BY O. Todd DATE 19 Mar 87					
6.	PROCESS CONDITIONS					
7.	CONTENTS (MAT'L): WASTE					
8.	SP.GR : < 2.0 BULK DENSITY : < 125 LBS/ FT^3					
9.	NORM. PRESS. < 0.5 PSIG. TEMP 70 BF					
10.	CONTRUCTION DETAILS					
11.	MIN. DESIGN PRESSURE : 0 PSIG					
12.	MIN. DESIGN TEMPERATURE : -15 B F MAX 150B F					
13.	MATERIAL: A36 STL VOLUME 15,000 GAL					
14.	INSTALLATION : (OUTDOOR)					
15.	WIND LOAD DESIGN: SEISMIC ZONE : 1					
16.	DESIGN CODE: API 650 ANGLE OF RESPONSE: N. A					
17.	ANGLE OF FRICTION AGAINST SIDE WALLS: N. A.					
18.	VERTICAL					
19.	ELEVATION ABOVE GRADE 20 FT 0 IN.					
20.	CONNECTIONS					
21	MARK	SERVICE	NO.REQ	SIZE	RATING	FACING
22.	A	FILL	1	3"	150#	RF
23.	B	RECIR	1	3"	150	RF
24.	CONSERVATION VENT & FLAME ARRESTOR					
25.	C		1	3"	150	RF
26.	D	SPARE	1	3"	150	RF
27.	E	MANWAY	1	16"	ASA	FLG
28.	& PRESS.REL. COVER VENT					
29.	F	MANHOLE & COVER	1	24"	API	FLG
30.	G	SUCTION	1	4"	150	RF
31.	H	SPARE	1	2"	150	RF
32.	J	LEVEL	1	4"	150	RF
33.	K	LEVEL	1	4"	150	RF
34.						
35.	REMARKS:					
	PROVIDE DROP TUBE TO WITHIN 6" OF BOTTOM ON (A& B). DROP (G) TO WITHIN 6" OF BOTTOM. PAINT W/ONE (1) COAT R.L. PRIMER & TWO (2) COATS LIGHT GRAY ENAMEL.					

Figure D-7 - Typical RCRA Waste Water Tank Inventory Control Log

Date	Description of Source or Destination	*Check appropriate column*		ICF Number	WPQ Number	Compatibility Group	Tank Start Level	Tank End Level	Inches Pumped	Total Gallons
		In	Out							

Appendix D.2.5
RCRA Tank Systems - Tank Operation Outline – Leachate Treatment System Description

The following is a summary of the Leachate Treatment System operations at the USEI Site B facility. The description of existing operating scenarios may, from time to time, be modified due to operational necessity, equipment modifications, and other unforeseen needs.

LEACHATE TREATMENT SYSTEM

When the presence of leachate is detected at the various sub-cell locations, the collected leachate is conveyed from the sub-cell primary sump via a submersible centrifugal pump installed in the side slope riser pipe. Each pump is provided with a low current sensing device that will automatically stop the pump when fluid flow is no longer present. The leachate is discharged to RCRA Tank #1 using the on-site mobile "vac" truck through a hose that is attached to a fitting provided at the top of the riser pipe, or via a hard piped system (Cells 15 and 16 and Sub-cell 14-6 only). During months when freezing temperatures could damage the piping system, all leachate is removed from the sumps using the "vac" truck.

The "vac" truck delivers the untreated leachate to the existing truck unloading/containment pad located on the southwest corner of the RCRA tank area at Container Storage Pad 4. The contents are pumped from the truck into RCRA Tanks through a hose connected to the tank fill line. Any minor spill encountered during the connection or disconnection of the fill hose to the truck (that is not captured by the use of drip pans) is contained in this unloading area, ultimately collected in an adjacent sump, and later transferred to RCRA Tanks for subsequent treatment.

Leachate that is detected at Sub-cell 14-6, Cell 15, or Cell 16 is conveyed from the primary sump via a submersible centrifugal pump installed in the side slope riser pipe. A submersible pressure transducer/transmitter attached to the primary leachate pump will monitor and provide a display of the liquid level in the sump. The level sensing system will also control the automatic cycling of the pump to properly withdraw the collected leachate from the sump. A low current sensing device will also cause the pump motor to stop when loss of fluid flow is detected (i.e., a "no-load" condition exists).

The leachate pump discharge is connected by a hose section into a hard-piped high density polyethylene (HDPE) pipeline installed at grade level that leads to the fill line for RCRA Tank #1. A flow sensor and flow totalizer system is provided at the inlet to the HDPE pipeline to record the total accumulated volume in gallons of leachate withdrawn and transferred to RCRA Tank #1. The HDPE pipeline is sloped in the direction of the pumped flow and is provided with the necessary drain valve(s) at the low point(s), as required, to completely evacuate any remaining liquid following pumping operations using the "vac" truck for subsequent transfer to RCRA Tank #1.

RCRA Tank #1 is provided with a level sensor that will detect a high level condition. This will provide an interlock that will automatically stop the primary leachate pump to prevent further transfer of leachate until the high level condition subsides.

A horizontal centrifugal *Untreated Leachate Feed Pump* conveys the leachate stored in RCRA Tank #1 to the treatment system at a rate of approximately 50 gpm. The suction and discharge piping to and from the pump is provided with the following components:

1. A single (simplex) basket strainer in the suction line to remove any gross solids that may be present in the liquid stream used to protect the feed pump.

2. A low-flow switch in the suction line designed to automatically stop the pump when there is insufficient liquid flow upon emptying the tank or if the basket strainer is clogged.
3. A pressure gauge in the discharge line to monitor pump performance.
4. A pressure switch in the discharge line to detect a low pressure condition which may be indicative of an upstream ruptured pipeline or other malfunction, and which will initiate an automatic shutdown of the pump.

The untreated leachate discharged from the pump is fed to a centrifugal separator/pleated cartridge type filter to remove finer suspended solids from the liquid stream that may foul/plug the downstream carbon filter media and interfere with the adsorption process. A pressure gauge is installed on both the inlet and outlet piping for this filter in order to determine the pressure differential (drop) across the unit while in operation. When the pressure drop across the filter exceeds the limit recommended by the filter manufacturer, the filter housing will be drained and the filter element (cartridge) cleaned or replaced as required.

The leachate is then fed into a set of three (3) granular activated carbon adsorption filters (*Leachate Scrub Units)* connected in series by piping and hoses. These filters have an activated carbon capacity of approximately 2,000 lbs. each. According to the average feed rate of approximately 50 gpm and the typical VOC concentration expected in the untreated leachate, the carbon filters are currently changed out when the pressure differential across the system becomes too great for processing to continue. Pressure gauges are installed in the interconnecting piping system to indicate the pressure reading at the inlet and outlet of each of the three (3) carbon filter vessels. This allows the pressure differential (drop) to be monitored across each carbon bed to ensure against plugging of the filters according to the manufacturer's operating guidelines. Additionally, a sampling valve is provided downstream of each carbon filter to periodically check the VOC removal efficiency.

A horizontal centrifugal *Treated Leachate Transfer Pump* conveys the leachate from the discharge of the carbon filters to RCRA Tank #4. This pump provides the additional head pressure (lift) needed to transfer the treated leachate to the receiving tank. The suction and discharge piping to and from the pump is provided with the following controls:

1. A low-flow switch in the suction line designed to automatically stop the pump when there is insufficient, or loss of, liquid flow from the carbon filters.
2. A pressure gauge in the discharge line to monitor pump performance.
3. A back pressure regulating valve in the discharge line to maintain a constant flow rate from the pump to match the feed rate through the carbon filters.
4. A pressure switch in the discharge line to detect a low pressure condition which may be indicative of an upstream ruptured pipeline or other malfunction, and which will initiate an automatic shutdown of the pump.

The discharge flow of treated leachate is directed into RCRA Tank #4. RCRA Tank #4 is provided with a level sensor probe to detect when the tank has been filled to capacity. When a high level "Tank Full" condition is detected, a corresponding pilot light will illuminate on the Leachate Control Panel, both the feed pump and the transfer pump will automatically shut off, and the fill valve for that tank will close. This will stop the flow of leachate through the treatment system until the tank is emptied and the system is restarted.

The treated leachate collected and stored in RCRA Tank #4 is pumped to the Evaporation Pond at a rate of approximately 100-120 gpm, using a horizontal centrifugal *Treated Leachate Discharge Pump* . The pump suction piping to RCRA Tank #4 is arranged and valved to permit the treated contents of the tank to be withdrawn and transferred at one time. The suction and discharge piping to and from the pump is provided with the following controls:

1. A low-flow switch in the suction line designed to automatically stop the pump when there is insufficient, or loss of, liquid flow from the selected tank.
2. A pressure gauge in the discharge line to monitor pump performance.
3. A pressure switch in the discharge line to detect a low pressure condition which may be indicative of an upstream ruptured pipeline or other malfunction, and which will initiate an automatic shutdown of the pump.

The treated leachate discharged from the pump flows through a hard-lined HDPE pipeline installed at grade level to a tie-in connection with a 6 ft. HDPE pipeline adjacent to Collection Pond-#3, which ultimately discharges into the Evaporation Pond. All HDPE pipelines are sloped to drain at a common point near the tie-in connection, and the necessary drain valve(s) at the low point(s) are provided as required to completely evacuate any remaining liquid following pumping operations, using the "vac" truck, which will then transfer this treated liquid to the Evaporation Pond.

Additional Information

During *normal* operation, the leachate is processed through one set of granular activated carbon adsorption filters, consisting of three (3) filters connected in series by piping and hoses with quick-connect end fittings. Should sampling and analysis show the VOC concentration and/or chemical constituents differ from the normal expected leachate characteristics, the existing piping, valve and hose connections can be configured to allow flow patterns for the following *alternative* method of processing leachate through the carbon filters:

The piping system can be arranged so leachate can be fed to both sets of carbon filters, with the sets configured for *parallel* flow operation. This will allow for one third (1/3) of the flow stream to be processed through each filter to increase the adsorption residence (contact) time and effectiveness of VOC removal.

The following bypass arrangements are present in the existing leachate treatment system piping:

1. Valved bypass from the discharge of the untreated leachate "feed" pump directly to the piping for the individual fill lines to RCRA Tanks #2, #3 and #4. This piping arrangement allows the bypass of both the particulate filters and the carbon filters, as well as all the associated flow and pressure controls previously described.
2. Valved bypass from the downstream side of the particulate (solids) filters directly to the piping for the individual fill lines to RCRA Tanks. This piping arrangement allows the bypass of only the carbon filters. However, the flow and pressure controls described in Items 1 and 2 remain functional.
3. Valved bypass from the discharge of the "return" pump to the outlet of the three (3) carbon filters in series, to allow for reverse-flow "backflushing" of the carbon filters. The "backflush" liquid can then be directed into RCRA Tank #1 by means of manual operation of valving for subsequent reprocessing through the treatment system.

Sampling and analysis of on-site treated leachate is conducted as follows:

1. At a minimum, biennially or after 300,000 gallons, the pretreated leachate will be analyzed for F039 constituents reasonably expected to be present. The volatile constituents which fail to meet wastewater standards will comprise the "fingerprint" parameters for the post-treated leachate.
    a. If "fingerprint" parameters exist for the post-treated leachate, one in every five (5) treatment batches will be verified to ensure proper treatment. Upon reaching the twentieth (20) batch, the fingerprint will be verified for each subsequent batch until the carbon is replaced. Once the carbon is replaced, the verification process begins with one in five again.

   b. If no "fingerprint" parameters exist, sampling will be conducted biennially or after 300,000 gallons. The carbon and/or filters will be replaced when operational constraints are met (i.e. the pressure differential across the filter increases substantially).

2. Treated leachate which meets the criteria set forth in the above paragraph may be disposed of in the facility's evaporation pond providing the pond parameters are verified as well. Leachate not meeting wastewater treatment standards and evaporation pond parameters as outlined in 40 CFR 268.40 and the WAP will be reprocessed and/or disposed of in accordance with 40 CFR and the WAP.

CALCULATION RECORD

Project: USEI, Stabilization Reconstruction
Subject/Item: Calc #01 - Mixing Tank Concrete Reinforcement
Revision Date: October 24, 2019
Prepared By: Vaughn Thurgood, PE

Purpose:

Confirm adequate steel reinforcement for the sidewalls of the stabilization mixing tanks, as needed to resist lateral earth pressures and equipment surcharge loads that will be imposed on the subsurface concrete vaults.

Given:

This analysis is based upon the following assumptions:

- Overall dimensions of the Mixing Tank concrete vaults are 15’ wide X 20’ long X 13’ deep.
- Concrete compressive strength is 4,000 psi with a minimum cover depth of 2 inches.
- Steel rebar yield strength is 60,000 psi.
- Structural backfill located around the concrete vault will consist of granular fill compacted to 95% modified proctor, which exhibits a minimum internal friction angle of 34 degrees and a moist unit weight of approximately 125 psf.
- A 30-ton excavator will be utilized for mixing purposes, which is capable of applying a boom crowd force up to 30 kips across a 4 foot wide bucket.
- Native subgrade materials are free draining. Groundwater is located near a depth of 100 feet or greater. Therefore exterior hydrostatic forces will not be considered.
- Neglect any additional wall and floor stiffness, which is provided by the 1-inch thick primary containment steel plates or the associated framing members that constitute the inner primary containment.

Solution:

Wall Stability – Empty Condition

The maximum inward overturning moment applied to the sidewalls of the concrete vault are applied when the mixing tank is empty and heavy equipment is located near the tank perimeter, applying a surcharge load.

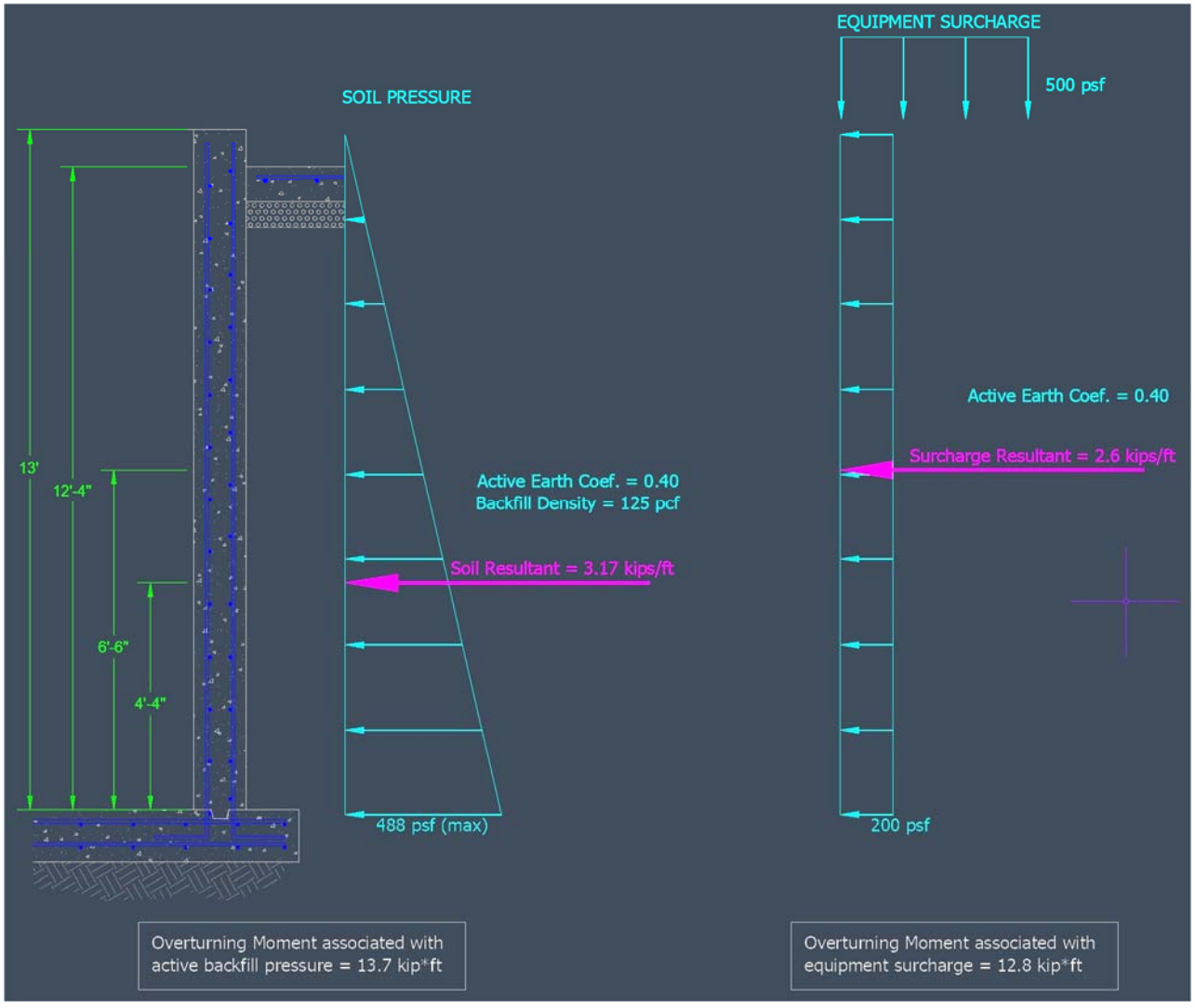
In this condition the vertical walls of the concrete vault are acting as a retaining wall to resist the active earth pressures that are transmitted by the retained structural backfill. The active earth pressure is modeled as an equivalent fluid pressure, based upon the internal friction angle of the structural fill.

CALCULATION RECORD

Project Name: USEI, Stabilization Reconstruction
Subject/Item: Calc #01 - Mixing Tank Concrete Reinforcement
Revision Date: October 24, 2019

A 325 Cat Excavator has a plan view footprint of 10' x 13' (130 sft). Therefore the equivalent uniform surcharge for the 30-ton unit would be approximately 460 psf. This surcharge load will conservatively be modeled as 500 psf.

The empty condition combined driving forces on the vertical walls are illustrated in the sketch below:



These overturning moments are partially mitigated, due the rigid structural effects of the rectangular vault. The enclosed spreadsheet calculations reflect wall analysis that is performed in accordance with the National Engineering Handbook, using vertical and horizontal moment coefficients, which are a function of the maximum wall height and wall length.

CALCULATION RECORD

Project Name: USEI, Stabilization Reconstruction
Subject/Item: Calc #01 - Mixing Tank Concrete Reinforcement
Revision Date: October 24, 2019

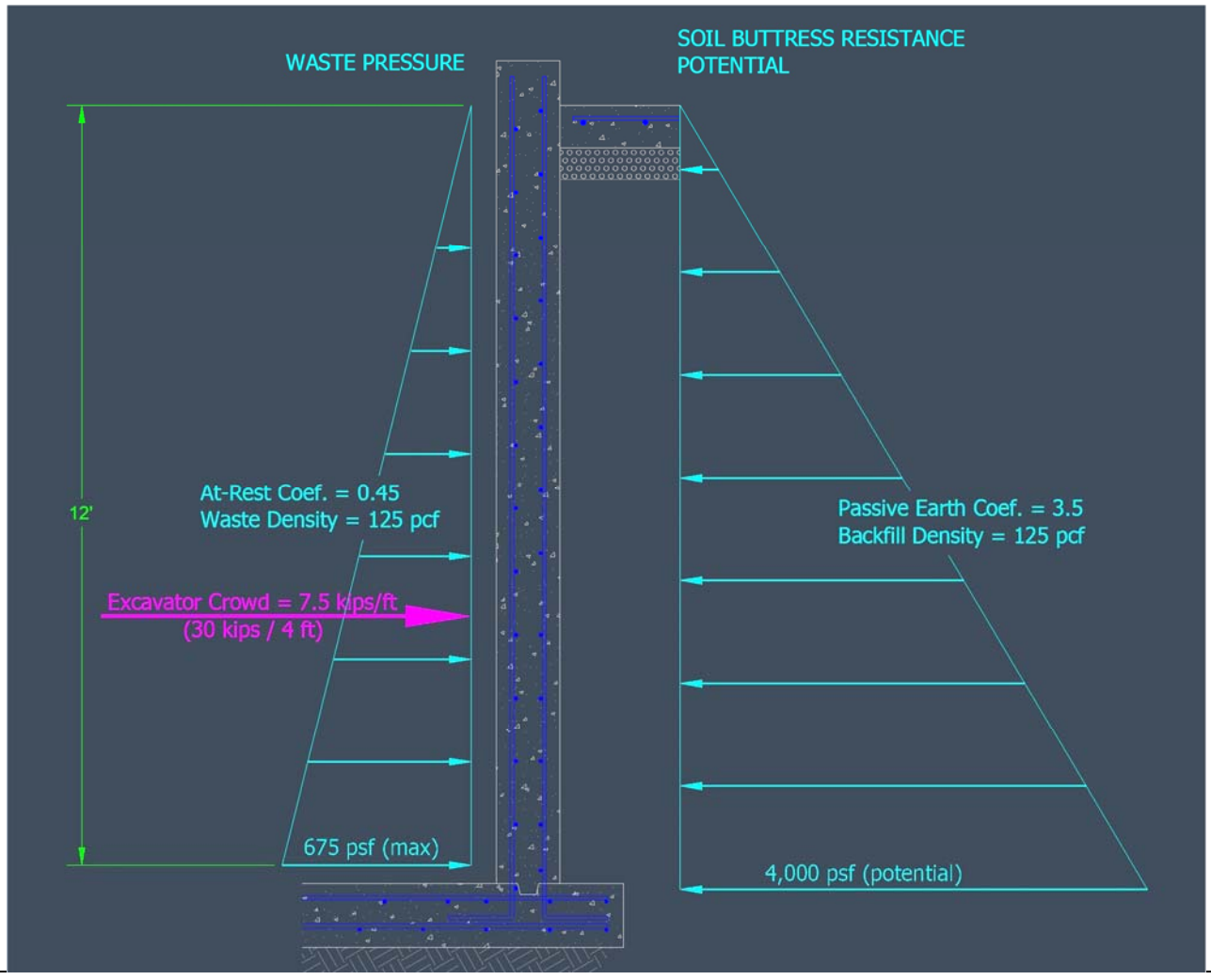
The spreadsheet analysis indicates that the minimum required steel reinforcement for stability is:

Min Vertical steel = 0.39 in^2/ft

Min Horizontal steel = 0.35 in^2/ft

Wall Stability – Operating Condition

The maximum outward overturning moment applied to the sidewalls of the concrete vault are applied when the mixing tank is filled to capacity and the maximum crowd force of the exactor boom is also applied to perimeter wall. In this scenario the concrete vault walls are fully buttressed by the structural backfill and the lateral forces applied by the internal waste materials and the excavator are offset by the passive resistance of the structural fill. The passive strength of the structural fill is approximately 10 times greater than the active forces that were considered previously in the empty condition. Subsequently the load forces and available resistance capacity are illustrated in the following figure.



CALCULATION RECORD

Project Name: USEI, Stabilization Reconstruction
Subject/Item: Calc #01 - Mixing Tank Concrete Reinforcement
Revision Date: October 24, 2019

Analysis of the loaded operating condition can be simplified by recognizing that the passive resistance of the exterior structural fill will adequately offset all lateral pressures exhibited by the internal waste materials. The effects of the remaining excavator boom crowd may be evaluated by identifying the maximum potential overturning moment and comparing these values with the capacity of the reinforced retaining wall, which was determined previously for the empty condition.

The surcharge load moment coefficients for the 13' x 20' wall are 0.13 for the vertical consideration and 0.19 for the horizontal consideration. The maximum potential overturning moment will occur when the crowd force is applied to the top portion of the wall. Therefore the maximum applied moments would be:

Vertical Steel Mu = 7.5 kips * 12 ft * 0.19 = 17.1 kip*ft (compare 17.8)

Horizontal Steel Mu = 7.5 kips * 12 ft * 0.13 = 11.7 kip*ft (compare 16.1)

Both of these values are below the respective total loads that were computed for the empty condition. Although these crowd force moment values are identified as close, in reality the moment resistance of the concrete vault walls is substantially higher when the additional available passive resistance of the structural fill is considered. It should also be considered that the steel reinforcement provided in the vertical and horizontal direction is always higher than the minimum required steel (see concluding recommendations).

Conclusions:

The steel reinforcement specified for the mixing tank concrete vaults consists of a double mat (located in both the inner and outer positions) as the follows:

Reinforced Concrete Vault Walls			
Reinforcement Components	**Rebar Specified**	**Steel Provided** (in^2)	**Min Steel Required** (in^2)
Vertical Steel	**#5 @ 9"**	**0.41**	0.39
Horizontal Steel	**# 5 @ 9"**	**0.41**	0.35

The steel reinforcement provided will exceed the required minimums.

CALCULATION RECORD

Project Name: USEI, Stabilization Reconstruction

Subject/Item: Calc #01 - Mixing Tank Concrete Reinforcement

Revision Date: October 24, 2019

Resources and References:

USDA Natural Resources Conservation Service. *National Engineering Handbook - Section 6, Structural Design*. 1980.

James MacGregor. *Reinforced Concrete Mechanics and Design – Third Edition*. Prentice Hall Publishing. Upper Saddle River, New Jersey. 1997.

Reinforced Concrete Design Analysis

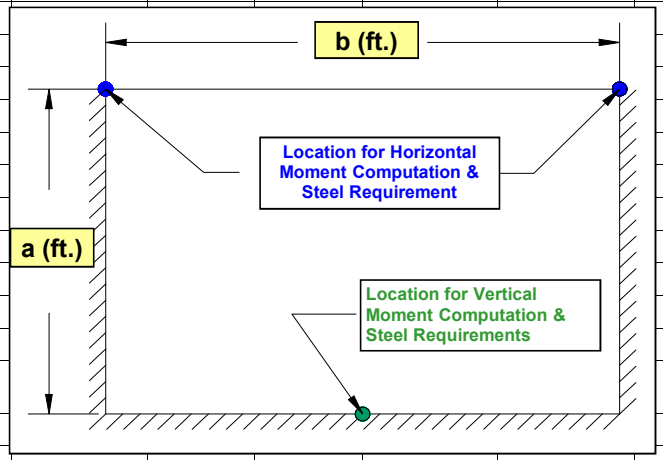
Feature: Mixing Tank Retaining Walls - Empty Condition

Prepared: V. Thurgood **Revised:** 10/24/2019

Lateral Earth Pressure Coefficient :	0.4
Moist Unit Weight of Soil (pcf) :	125
Concrete Compressive Strength (ksi) :	4
Yield Strength of Steel (ksi) :	60
Wall Thickness (in.) :	12
Effective Depth to Vertical Steel (in.) =	9.5
Effective Depth to Horizontal Steel (in.) =	8.5
Concrete Shear Strength (kips) =	14.42

Notes:

1. Ultimate moment, Mu, includes a load factor of 1.8 and a strength reduction factor of 0.9.
2. Shear strength, Vu, includes a load factor of 1.8 and a strength reduction factor of 0.85.



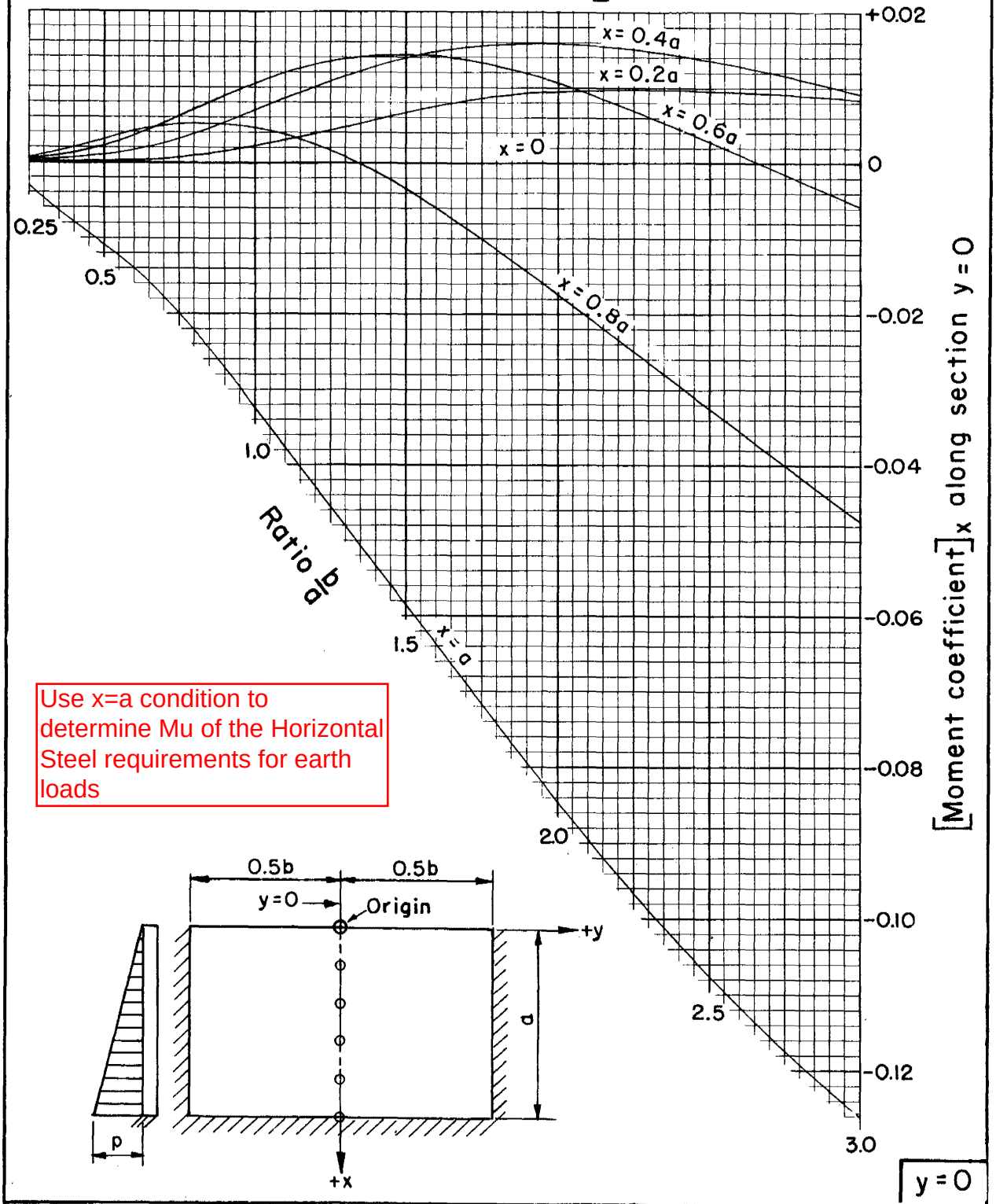
Bending Moment Locations

		Moment Coef. Vertical Steel		Moment Coef. Horizontal Steel		Vertical Steel			Horizontal Steel				
a	b	Earth Load	Surcharge Load	Earth Load	Surcharge Load	Mn,e	Mn,s	Mu,Total	Mn,e	Mn,s	Mu,Total	As, V	As, H
(ft)	(ft)							(ft.-kips)			(ft.-kips)	(sq. in.)	(sq. in.)
13	20	-0.061	-0.13	-0.044	-0.19	-6.7	-2.2	-17.8	-4.83	-3.2	-16.1	**0.39**	**0.35**

STRUCTURAL DESIGN : Rectangular slabs with hydrostatic load; coefficients for vertical moment, M_x, at fifth points on vertical slice y = 0

Vertical moment determines tension in vertical steel

$M_x = [\text{Moment coefficient}]_x \, pa^2$

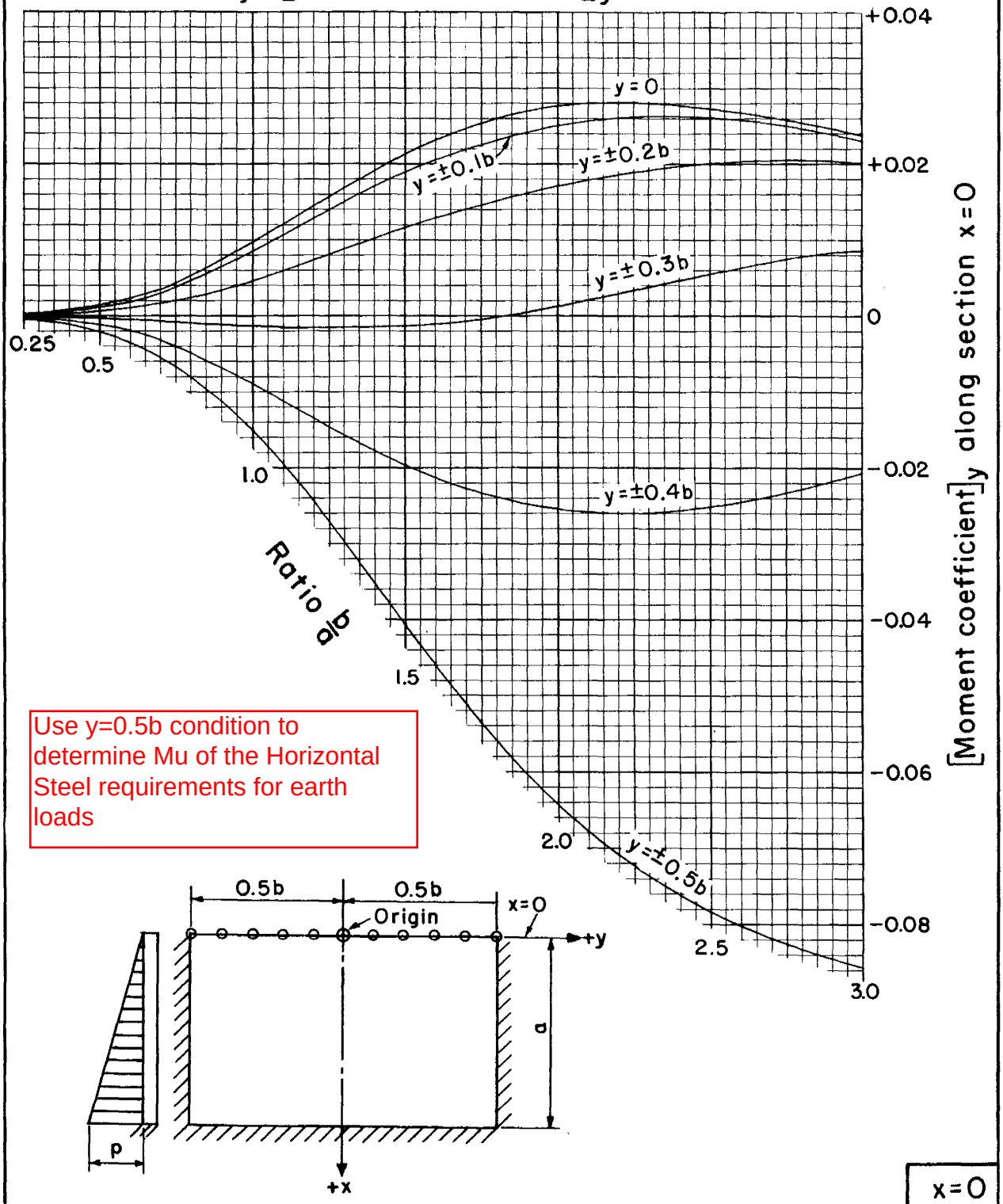


REFERENCE		STANDARD DWG. NO.
U. S. Bureau of Reclamation photoelastic analysis unit report No. 30, December 1954	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING DIVISION - DESIGN SECTION	ES-104 SHEET 2 OF 85 DATE 8-1-55

STRUCTURAL DESIGN: Rectangular slabs with hydrostatic load; coefficients for horizontal moment, M_y, at tenth points on horizontal slice. x=0

Horizontal moment determines tension in horizontal steel

$M_y = [\text{Moment coefficient}]_y \, pa^2$



Use y=0.5b condition to determine Mu of the Horizontal Steel requirements for earth loads

x=0

REFERENCE
U. S. Bureau of Reclamation photoelastic analysis unit report No. 30, December 1954

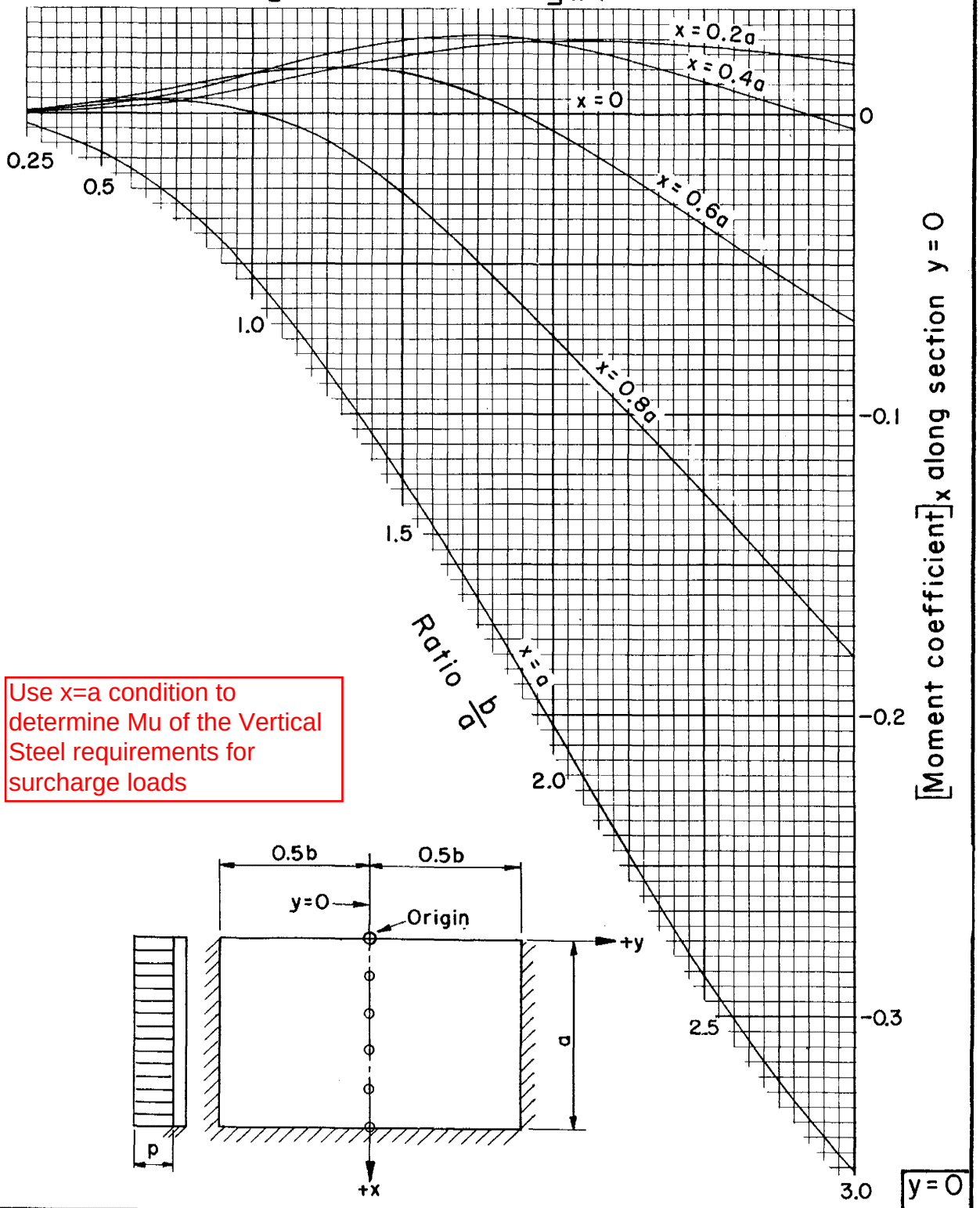
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ENGINEERING DIVISION - DESIGN SECTION

STANDARD DWG. NO.
ES-104
SHEET 8 OF 85
DATE 8-1-55

STRUCTURAL DESIGN : Rectangular slabs with uniform load; coefficients for vertical moment, M_x, at fifth points on vertical slice y = 0

Vertical moment determines tension in vertical steel

M_x = [Moment coefficient] x pa^2



y = 0

REFERENCE

U. S. Bureau of Reclamation photoelastic analysis unit report No. 30, December 1954

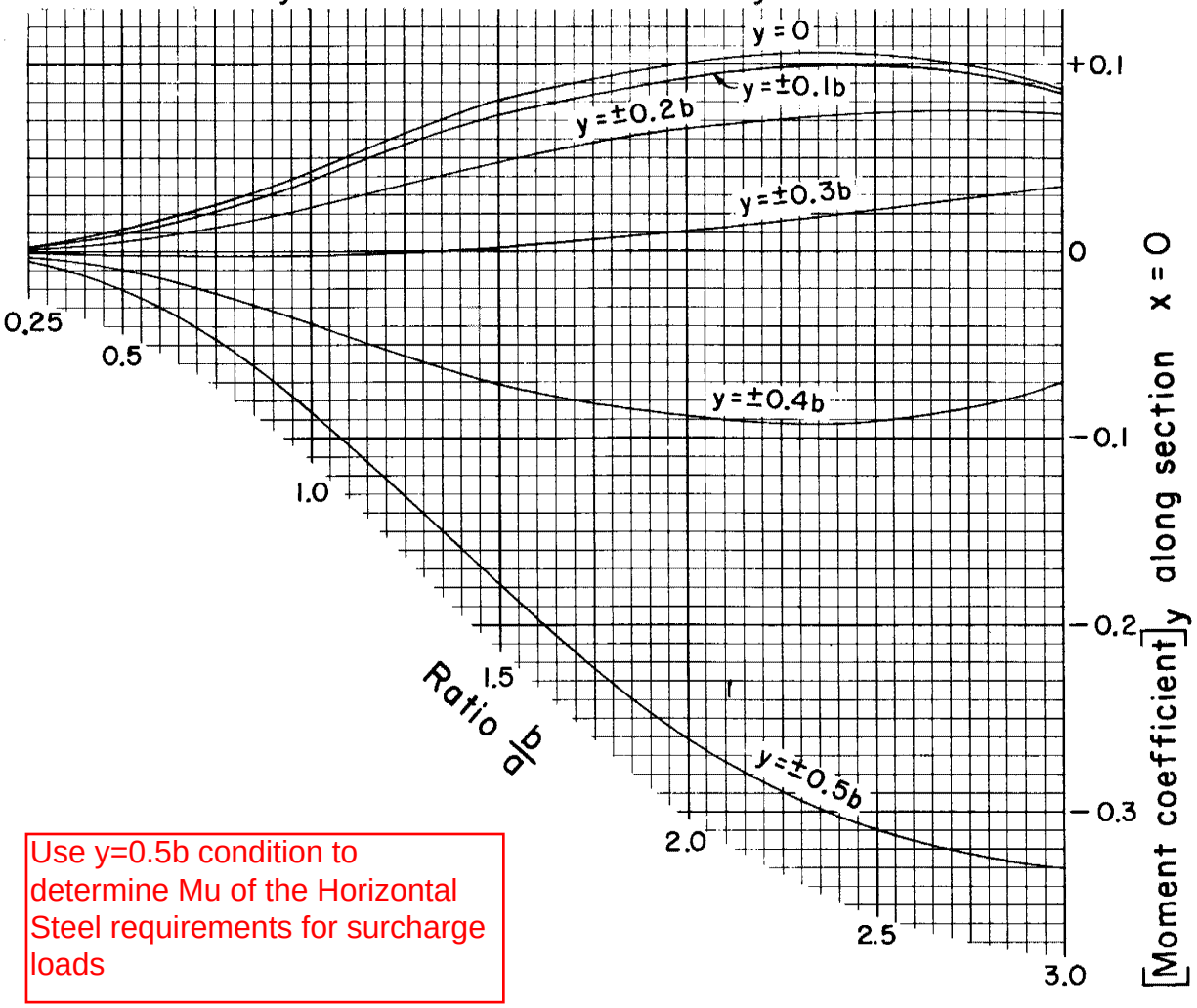
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ENGINEERING DIVISION - DESIGN SECTION

STANDARD DWG. NO.
ES-104
SHEET 44 OF 85
DATE 8-1-55.

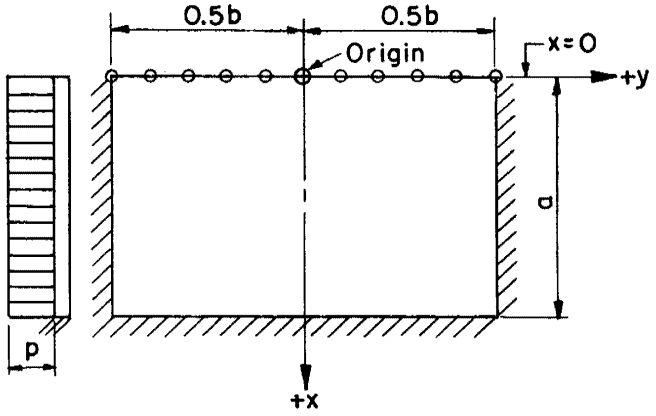
STRUCTURAL DESIGN : Rectangular slabs with uniform load ; coefficients for horizontal moment, M_y, at tenth points on horizontal slice x = 0

Horizontal moment determines tension in horizontal steel

M_y = [Moment coefficient]$_y$ pa^2



Use y=0.5b condition to determine Mu of the Horizontal Steel requirements for surcharge loads



x = 0

REFERENCE

U. S. Bureau of Reclamation photoelastic analysis unit report No. 30, December 1954

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ENGINEERING DIVISION - DESIGN SECTION

STANDARD DWG. NO.
ES-104
SHEET 50 OF 85
DATE 8-1-55

Area of Steel Per Foot of Beam Width

Feature: Mixing Tank Retaining Walls

Prepared: V. Thurgood **Revised:** 10/24/2019

		Bar Size				
	Spacing	**#4**	**#5**	**#6**	**#7**	**#8**
Spacing	**3**	0.79	1.23	1.77	2.40	3.14
	6	0.39	0.60	0.89	1.20	1.57
	9	0.26	0.41	0.59	0.80	1.05
	12	0.20	0.31	0.44	0.60	0.79
	15	0.16	0.25	0.35	0.48	0.63
	18	0.13	0.20	0.29	0.40	0.52

All areas listed in square inches