TECHNICAL MEMORANDUM

Pilot Study Results to Support the Remedial Investigation at
UXO 3 – Dredge Pond 3E and Northern Marine Corps Firing Range
Former Mare Island Naval Shipyard, Vallejo, California
Contract N62473-11-D-2228, Task Order 006, DCN: BATL-2228-0006-0007

FINAL **June 2016**

This Technical Memorandum describes the results of a two-day pilot study conducted on December 16 and 17, 2015, as outlined in the *Letter Work Plan for the Pilot Study to Support the Remedial Investigation at UXO 3 – Dredge Pond 3E and Northern Marine Corps Firing Range Former Mare Island Naval Shipyard, Vallejo, California* (UXO 3 Pilot Study Letter Work Plan; Battelle, 2015a). The purpose of the pilot study was to test key aspects of the field work for the remedial investigation (RI) technical approach as outlined in the *Final Work Plan Remedial Investigation at UXO 3 – Dredge Pond 3E and Northern Marine Corps Firing Range Former Mare Island Naval Shipyard Vallejo, California* (UXO 3 RI Work Plan; Accord MACTEC 8A JV, 2013), to refine the technical approach prior to field work. The pilot study evaluated the degree to which vegetation will need to be cleared to conduct digital geophysical mapping (DGM) and radiological surveys and tested the use of planned survey equipment (i.e., DGM and radiological) and the construction equipment (i.e., drill rig and a mini-excavator) outlined in the *UXO 3 RI Work Plan* (Accord MACTEC 8A JV, 2013). The results of the pilot study provided valuable insight into working on the dredge pond levee and in the dredge pond bottom. In addition, the California Department of Fish and Wildlife (CDFW) was onsite during the pilot study and provided input on how and when vegetation clearance should be conducted to minimize impacts to sensitive species. Based on the findings of the pilot study, a revised technical approach to the RI is recommended.

BACKGROUND

The UXO 3 RI Work Plan (Accord MACTEC 8A JV, 2013) describes the technical approach for implementing the RI under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for material potentially presenting an explosive hazard (MPPEH), munitions constituents (MC), radiological contamination, and chemical contaminants at Unexploded Ordnance (UXO) Site 3, which consists of Dredge Pond 3E (portion located east of the Joy Survey Line) and the Northern Marine Corps Firing Range (NMCFR) at the Former Mare Island Naval Shipyard, Vallejo, California (Figure 1). Dredge Pond 3E is an approximately 46-acre area within the former Mare Island dredge pond system. As part of the RI, UXO-3 will be investigated to determine potential risks and hazards that may be associated with site conditions. The site lies a few feet above sea level and is generally flat, disrupted only by dredge pond levees that extend up to 10 ft higher than the dredge pond bottom.

PILOT STUDY IMPLEMENTATION

As described in the UXO 3 Pilot Study Letter Work Plan (Battelle, 2015a) the first day of the pilot study focused on vegetation clearance along the levee road leading to the pilot study area location and clearing vegetation in the 50 by 50 ft pilot study area (Figure 2). Day two of the pilot study involved testing survey (DGM and radiological) and heavy equipment maneuverability within the pilot study area.

In accordance with the Accident Prevention Plan (Battelle, 2015b), a tailgate safety meeting was held each morning whereby the Site Safety and Health Officer (SSHO) reviewed the Site Health and Safety Plan (Battelle, 2015c), focusing on the activity hazard analyses (AHAs) specific to the task (i.e., day one: vegetation clearance, day two: equipment testing) and briefed the field crew on general and site-specific

safety concerns and procedures. In addition, a munitions and explosives of concern (MEC) safety briefing was presented by the UXO Technician II and a special status species awareness brief (focusing on the salt marsh harvest mouse [SMHM] and potential presence of migratory birds) was presented by the biological monitor. On Day One of the pilot study, in addition to the Battelle field team and supporting subcontractors, representatives from the Navy and the CDFW were onsite to observe the pilot study activities. On Day Two of the pilot study, in addition to the personnel mentioned above, representatives from the Department of Toxic Substances (DTSC) and the San Francisco Regional Water Quality Control Board (Regional Water Board) were onsite to observe the pilot study activities.

Day One of the pilot study was dedicated to delineating the pilot study location and clearing vegetation along the levee road and within the pilot study area. The levee road (i.e., access path to the pilot study area) was cleared using a two-man field crew led by a UXO Technician II and a biological monitor to facilitate survey and heavy equipment access to the pilot study area. The vegetation along the levee road consisted primarily of tall, approximately 6 ft fennel and was cleared down to approximately 3 inches above ground surface (ags) primarily using handheld mechanized (fixed blade) weedeaters (Figures 3A and 3B).

As the access path to the pilot study area was being cleared of vegetation, the field team leader continued down into the pilot study area led by the UXO Technician II and the biological monitor to delineate the pilot study area location. Survey stakes and ribbon were used to delineate the 50 by 50 ft area where the pilot study was to be conducted. As the vegetation clearance team approached the pilot study area from the levee road, a path was cleared from the levee road to the pilot study area location through a relatively dense patch of approximately 6 ft tall fennel. Upon clearing the access path to the pilot study area, the vegetation clearance field team split up and one field team member began clearing the levee road of cut fennel debris and loading it onto the vegetation clearance team support truck to be hauled offsite, while the other vegetation clearance field team member began clearing the vegetation within the pilot study area. The pilot study area, consisting entirely of dense pickleweed, was cleared utilizing the fixed-blade handheld mechanized weedeater (Figures 3C and 3D).

As outlined in the UXO 3 Letter Work Plan (Battelle, 2015a) the vegetation clearance crew approached the pickleweed with the handheld mechanized weedeaters and began clearing the pickleweed. Soon after the pickleweed vegetation clearance began, the CDFW representative suggested that the pickleweed vegetation clearance crew work from the top of the pickleweed down to the 3-inch target height by cutting the pickleweed in increments to minimize potential harm to the SMHM. The reasoning provided by the CDFW representative was that this top-down pickleweed clearance approach provided a warning to the SMHM, allowing it time to escape the potential dangers presented by the handheld mechanized weedeaters. This approach was immediately adopted in the field whereby the vegetation clearance crew cut the pickleweed from the top down in three approximately 5-inch intervals down to the target height of 3 inches ags. The results are provided in the subsequent section.

Day Two was dedicated to testing the capability of the survey and heavy equipment to access the pond bottom from the levee road and conducting maneuverability testing within the pilot study area. The equipment mobilized to the site to support this portion of the pilot study included an EM 61 MK2A DGM (cart-mounted) instrument (Figure 4A), Cabrera's Large Area Scanning System (CLASS) for radiological surveys, which was mounted on the back of utility task vehicle (UTV) (Figure 4B), a mini-excavator (Figure 4C), and a limited access, track-mounted, drill rig (Figure 4D). Each piece of equipment listed above was tested individually within the pilot study area. The results of the survey and heavy equipment testing is provided in the section below.

PILOT STUDY RESULTS

Vegetation Clearance

The handheld mechanized equipment used to clear the vegetation along the levee road (primarily fennel, approximately 6 ft tall) was sufficient to clear the fennel along the levee road. The pilot study test area included a flat area located within the dredge pond bottom, which was covered with moderately dense pickleweed, approximately 18 inches in height. The levee slope was also comprised of pickleweed, which was determined to be significantly denser and growing at a height of approximately 36 inches. The pilot study area within the pond bottom was cleared using an incremental (4 to 5 inch increments), top-down cutting approach (requested by the CDFW) to approximately 3 inches ags (Figure 3C). This area was approximately 15[1] by 50 ft in size and took approximately 1 hour and 10 minutes to clear, corresponding to a vegetation clearance rate of approximately 750 ft^2/hr.

Next, the vegetation was cleared on the sloped portion of the pilot study area along the levee using a similar approach (Figure 3D). Several approaches to pickleweed cutting were attempted in an effort to achieve the maximum cutting rate while implementing the modified top-down pickleweed cutting approach, including cutting up slope, cross-slope, and down slope. Observations made while clearing the sloped portion of the pilot study area indicated that pickleweed clearance posed an increased risk to safety when working from the top down and cross-slope. As a result, clearing pickleweed while moving from the pond bottom up slope, toward the levee road, was the safest and most efficient approach to clearing pickleweed with the handheld mechanized equipment. This portion of the pilot study area was approximately 30 by 50 ft in size and took approximately 5 hours to clear to 3 inches ags, resulting in a vegetation clearance rate of approximately 300 ft^2/hr.

The hand-held mechanized equipment selected to clear vegetation for the pilot study performed adequately when clearing vegetation on the levee road (i.e., fennel in moderately dense growth patches). The vegetation clearance field team was able to cut down the vegetation in this area relatively efficiently and without any issues. However, vegetation clearance within the pilot study test area was complicated by several issues that were unforeseen prior to conducting the pilot study. Pickleweed height and density varied substantially between the flat and sloped portions of the pilot study area. Pickleweed growing on the sloped portion poses several challenges to clearing using weedeaters. The pickleweed located on the slope of the levee is (1) significantly denser, and grows taller than the pickleweed in the pond bottom flats; and (2) grows in a down slope direction, which makes it difficult to safely cut the pickleweed with handheld mechanized weedeaters when moving in a down slope direction. Based on the results of the pilot study, pickleweed on the levee slope can only be cleared when moving from the bottom of the levee towards the top. Also, the implementation of the systematic top-down cutting approach requested by CDFW required the pickleweed to be cut in multiple iterations in order to give the SMHM time to escape the work area.

Upon completion of the equipment testing portion of the pilot study, the Battelle field team, led by the UXO Technician II and the biological monitor, conducted a full site walk with all key personnel including subcontractors and agency representatives in an effort to facilitate a shared understanding of the site conditions. Two notable observations were made during the site walk. The first notable observation was that the levee road on the northwestern levee is almost entirely covered with thick woody trees/shrubs (Figure 5) and bushes (primarily coyote bush) that cannot be cleared utilizing the handheld mechanized equipment used during the pilot study. The current technical approach is to clear pickleweed and

[1] Note that there is an approximate 5 ft wide mud flat area that runs the length of the pilot study area between the pond flat and where the slope of the levee begins where vegetation is non-existent and is not included in this estimate.

cattail/fennel dominated areas with weedeaters (i.e., a majority of the site) and work around large obstructions that cannot be cleared using this equipment. Based on input received from CDFW and the biological monitor, many areas of the site, specifically the trees/brush, could potentially be used for nesting between March and September by birds protected by the Migratory Birds Treaty Act (MBTA). As such, vegetation clearance would need to be conducted prior to March because the site will likely be used by nesting migratory birds. The MBTA requires a buffer of up to 100 ft for common birds and up to 300 ft for raptors. The presence of nesting birds would result in a large area of the site that would fall within the buffer area and, thus, be inaccessible for field work.

The second notable observation made during the site walk was that the vegetation that exists in the Northern Marine Corps Firing Range (MCFR) area is best characterized as a thick, thatched mat of dormant salt grass, approximately 6 to 8 inches thick, with sporadic occurrences of taller vegetation, including 2- to 3-ft tall mustard plants, interspersed cattail and minor occurrences of pickleweed. The limited survey work in the Northern MCFR area (i.e., three transects) can be accomplished using hand-towed carts to perform radiological and DGM surveys (Figure 5) in less than three days and without the use of heavy equipment. As a result, the biological monitor recommended that silt fence not be installed within this area of the site because the installation process would pose a greater overall risk to the SMHM than the limited survey work planned in the area. The biological monitor and the CDFW agreed that a biological monitor walking ahead of the slow-moving survey equipment to be used in this area would be the best and least intrusive approach to completing the survey effort in the Northern MCFR area.

Survey and Heavy Equipment Testing

Equipment testing successfully demonstrated that each piece of equipment was able to navigate to and into the pilot study area. Each piece of equipment was tested individually to confirm its capability to enter and exit the pond bottom from the levee road and conduct its assigned simulated task within the pilot study area. The results for each individual equipment test are summarized below.

The cart-mounted DGM instrument was able to navigate into and out of the pond from the levee road without any issues. Once inside the pilot study area, the cart-mounted DGM instrument was able to navigate over the cleared flat portion of the pilot study area while maintaining a stable survey platform without any issues. Due to the steepness of the grade of the sloped portion of the pilot study area, the geophysicist operating the DGM cart recommended conducting the DGM surveys parallel to slope (Figure 4A) in order to keep the DGM cart level to maximize the quality of the DGM data that will ultimately be collected. This method proved successful.

The UTV carrying CLASS was tested next. The UTV was able to navigate into and out of the pond from the levee road without any issues. Once inside the pilot study area, the UTV was able to navigate over the flat and sloped portions (Figure 4B) of the pilot study area with minimal effort and without any issues.

The mini-excavator was able to navigate into and out of the pond from the levee road with relative ease. Once inside the pilot study test plot, the excavator was able to adequately maneuver within the cleared flat and sloped portions of the pilot study area with minimal effort and without any issues. A mock test involving positioning the mini-excavator over a test dig location was conducted (Figure 4C). The mini-excavator was able to set up on the sloped surface without any issues.

The limited access drill rig was able to navigate into and out of the pond from the levee road with minimal effort. Once inside the pilot study test plot, the limited access drill rig was able to navigate over the flat and sloped portions of the pilot study area with minimal effort and without any issues. A mock

test involving setting up the drill rig in preparation for drilling into the subsurface was conducted (Figure 4D). The drill rig was able to set up on the sloped surface without any issues.

The equipment testing portion of the pilot study successfully demonstrated the use of all equipment within the study area. However, the pilot study did identify several issues related to vegetation clearance and avoidance of special species and migratory birds.

CONCLUSIONS AND RECOMMENDATIONS

The survey and heavy equipment selected to perform specific project tasks supporting the RI were successfully tested under representative field conditions present with the pilot study area. The survey and heavy equipment pilot test results showed that each piece of survey and heavy equipment performed its task without any issues and, as a result, the survey and heavy equipment selected for the pilot study will remain the equipment of choice during full-scale RI activities.

The results of the vegetation clearance portion of the pilot study have raised several issues that otherwise would not have been apparent prior to mobilization. Based on the results from the vegetation clearance portion of the pilot study and input from the CDFW representative, the conclusions of the pilot study are as follows:

- Cutting the vegetation from the top down in the iterative manner requested by CDFW (i.e., approximately 5 inch increments) requires additional level of effort; however, this is offset by the reduction of effort that would have been needed for removing and hauling the cuttings off site.
- There is a significant difference in growth patterns between the pickleweed on the pond bottom and the pickleweed growing on the levee slope.
- Pickleweed clearance on the sloped portion of the levee can only be accomplished safely by advancing weedeaters from the bottom to the top of the berm; the CDFW representative requested that clearance be conducted in the opposite direction in order to force the SMHM into the dredge pond rather than towards the road.
- CDFW was receptive to the use of heavy equipment to clear pickleweed on the sloped area as long as the equipment remained on the berm top and was used to advance clearance activities towards the dredge pond bottom (i.e., from the top to the bottom of the berm), the vegetation is cut in increments, and the area is cleared by the biological monitor prior to cutting.
- CDFW requested that vegetation be cut to approximately 3 inches ags because it creates an open space that acts as a natural barrier that the SMHM will not enter due to insufficient cover.
- Survey and heavy equipment are operational when vegetation is cut to 3 inches ags.
- It is acceptable to leave the cut pickleweed in place because it reduces unnecessary vehicle and foot traffic to remove clippings in sensitive habitat areas.
- Leaving the cut vegetation on the ground, particularly the pickleweed, will facilitate a more rapid recovery for the sensitive habitat by promoting reseeding following project completion.
- The vegetation at the site, and in particular the woody vegetation on the northern berm (see Figure 5), will likely be used by nesting migratory birds that would result in large buffer areas that would limit the RI activities from being conducted as planned.

- Clearing the woody vegetated area is not possible with the handheld vegetation clearance equipment planned for use at the site (i.e., weedeaters).
- Larger, mechanized equipment could be used to clear vegetation along the levee road (including the woody area) and levee slopes utilizing a brush mulcher attached to an extended arm that is mounted on a tractor or excavator that would remain on the levee road.
- Installing a wildlife exclusion fence in the northern portion of the NMCFR investigation area to support the limited non-mechanized surveys planned in this area potentially poses a greater risk to the SMHM than if the limited non-mechanized surveys were conducted over the transects without the wildlife exclusion fence installed in the area.

Upon reviewing the results of the pilot study and considering the observations made in the field and the conversations conducted between the technical field staff and the biological monitor and CDFW, a modified technical approach is recommended to complete RI field activities at UXO 3. The modifications to the current approach primarily relate to minimizing the impact of invasive clearance activities in sensitive habitat areas. The modified logistical and technical approach is presented below. The approaches will be described in detail in the supplemental work plan documents, which will be reviewed by the regulatory agencies.

Recommendation #1: Conduct Work in Two Phases. The original proposed schedule involved allowing the site to dry out and initiating site preparation activities in early summer (late June or early July), then the remaining RI field activities would be initiated from mid-summer until early fall. Because of the site setting (i.e., seasonal wetland), there is only a narrow timeframe when the site is dry enough to conduct field work. Furthermore, based on input received from the biological monitor and the CDFW representative, the site will be used by both nesting birds and active SMHM nests in the summer, which will essentially result in buffer areas that will limit RI work in potentially large areas of UXO 3. Therefore, based on the results of the pilot study and input from the biological monitor and CDFW, the contractor recommends an alternate project schedule for conducting RI field activities in two phases:

- **Phase I:** Phase I would involve conducting vegetation clearance on the levee tops between September and December 2016. This timeframe is favorable because it would (1) allow sufficient time for the site to dry out; (2) would occur during the off season of the migratory bird nesting season and the off season of the SMHM mating/nesting season; and (3) would occur prior to the start of the 2016/2017 rainy season. In addition, clearing the vegetation from the levee tops in a separate effort during this timeframe in advance of RI field activities would also minimize the habitat for nesting birds and SMHM during the nesting season (i.e., summer 2017). Silt fence would not be installed during Phase I.
- **Phase II:** Phase II would involve completing all remaining RI field activities, with mobilization taking place in the summer of 2017, once the site is dry enough to support heavy equipment (i.e., expected to be in late June or early July 2017). Re-clearance of vegetation on the levee tops would be conducted if required, followed by vegetation clearance on the levee slopes and pond bottom. Silt fence would be installed immediately following vegetation clearance. The surface surveys (i.e., radiological and DGM surveys) would be performed following the site preparation (vegetation clearance and silt fence installation). Phase II would also include completing RI field work by using GPS to reacquire the DGM and radiological anomalies identified during the surface surveys, investigating the DGM and radiological anomalies, completing soil investigations and sampling, and installing temporary wells to collect groundwater samples.

Recommendation #2: Use Heavy Equipment to Clear the Levee Top and Slope. The modified technical approach to vegetation clearance involves using mechanized heavy equipment similar to a skidsteer or tractor with a frontend or side mounted brush mulcher to mulch the fennel and coyote brush on the levee roads (Figure 5) down to approximately 3 inches ags. Because the vegetation present on the levee roads is not the primary habitat for sensitive species such as the SMHM, there is little risk of take in utilizing this approach. Once the levee roads are cleared of vegetation and the open space natural barrier is created, a tractor equipped with a mechanical arm and brush mulcher attachment (Figure 6) will be used to clear the vegetation on the sloped portions of the levees using the top-down pickleweed cutting approach recommended by the CDFW during the pilot study activities. Under this approach, the tractor would remain on the levee top while the mulcher would cut the pickleweed along the levee slope from the top of the levee down and out toward the pond bottom (while utilizing the top-down cutting approach). The biological monitor will walk the area to be cleared in advance of the clearing equipment. This approach prevents any person or machine from entering the pickleweed on the sloped portion of the levee while it is being cut and the top-down cutting approach allows ample warning for wildlife to vacate the area, which will decrease the risk to the SMHM. Following vegetation clearance along the levee slope, a vegetation clearance field crew of approximately six to eight laborers would be deployed down into the pond bottom to clear the remaining pickleweed using hand-held, motorized weedeaters. Clearance activities would advance from the outside of the pond toward the inside of the pond to allow wildlife to escape into the uncut pickleweed. It is expected that woody vegetation cut by the brush mulcher will be reduced to small pieces that can be left on the ground.

Recommendation #3: Limit Silt Fencing to the Dredge Pond 3E Bottom. The contractor recommends that a wildlife exclusion fence be installed within the pond bottom only, as shown in Figure 5. This approach takes into account the fact that the top of the levee will be cleared to 3 inches ags resulting in a large, open, cleared area that produces a natural barrier, making it unlikely that the SMHM will enter the work area and negating the need for a wildlife exclusion fence along the outside of the levees that bound Pond 3E. The silt fence should be installed along the pond bottom after the vegetation clearance activities are completed to avoid animal trapping issues. Silt fence will be installed in the pond bottom at the cut/uncut pickleweed boundary to prevent the SMHM that may be present in the adjacent uncut pickleweed from entering the work area.

In addition, the current approach to conducting RI work in the NMCFR area only includes three approximately 5-ft wide survey transects (Figure 5), which will be conducted using handheld equipment and will require less than three days of access. Since radiological and DGM surveys will be conducted using man-towed carts and surveys will take less than three days, a wildlife exclusion fence will not be installed in this area. It is the opinion of the biological monitor that because the duration of the work is short and does not involve using heavy mechanized equipment, installing a wildlife exclusion fence in the Northern MCFR area would have more adverse impacts than the work itself.

The overall objective of the pilot study was to test the RI technical approach as outlined in the UXO 3 RI Work Plan (Accord MACTEC 8A JV, 2013) against site conditions. The results of this pilot study were valuable in highlighting issues related to specific site conditions that would not have otherwise been apparent had the pilot study not been conducted. The modifications to the technical approach described herein reflect a conservative strategy that minimizes impacts to sensitive species and still allows the project objectives to be achieved.

REFERENCES

Accord MACTEC 8A JV. 2013. *Final Work Plan Remedial Investigation at UXO 3 – Dredge Pond 3E and Northern Marine Corps Firing Range Former Mare Island Naval Shipyard Vallejo, California.* Prepared for the Base Realignment and Program Office West, San Diego, CA. May.

Battelle. 2015a. *Letter Work Plan for the Pilot Study to Support the Remedial Investigation at UXO 3 – Dredge Pond 3E and Northern Marine Corps Firing Range Former Mare Island Naval Shipyard, Vallejo, California,* Prepared for the Base Realignment and Closure Program Office West, San Diego, CA. December.

Battelle. 2015b. *Accident Prevention Plan Remedial Investigation at UXO 3 – Dredge Pond 3E and Northern Marine Corps Firing Range Former Mare Island Naval Shipyard Vallejo, California.* Prepared for the Base Realignment and Closure Program Office West, San Diego, CA. December.

Battelle. 2015c. *Site Safety and Health Plan Remedial Investigation at UXO 3 – Dredge Pond 3E and Northern Marine Corps Firing Range, Former Mare Island Naval Shipyard Vallejo, California.* Prepared for the Base Realignment and Closure Program Office West, San Diego, CA. December.

Figure 1. Site Location

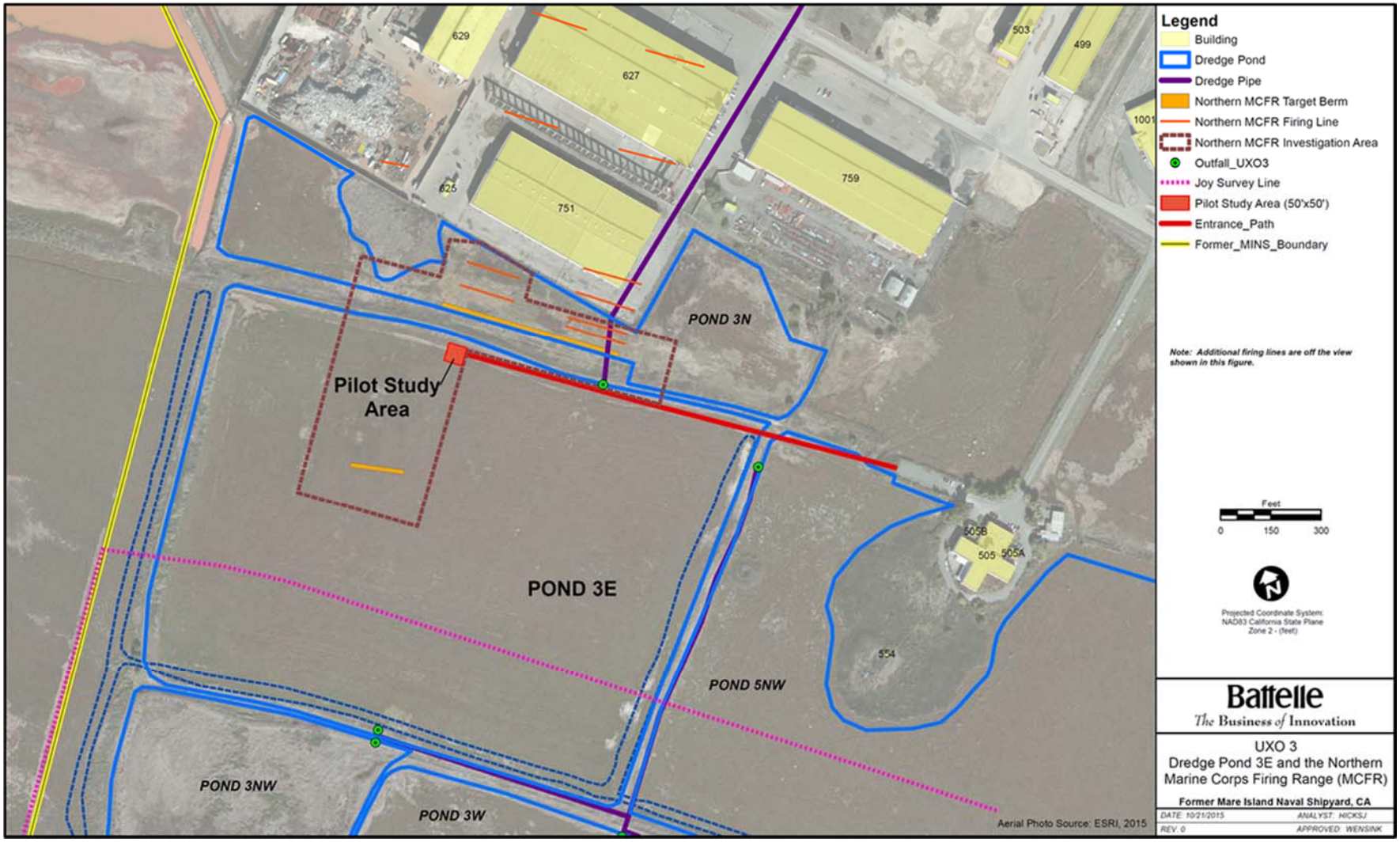

Figure 2. Pilot Study Area Location

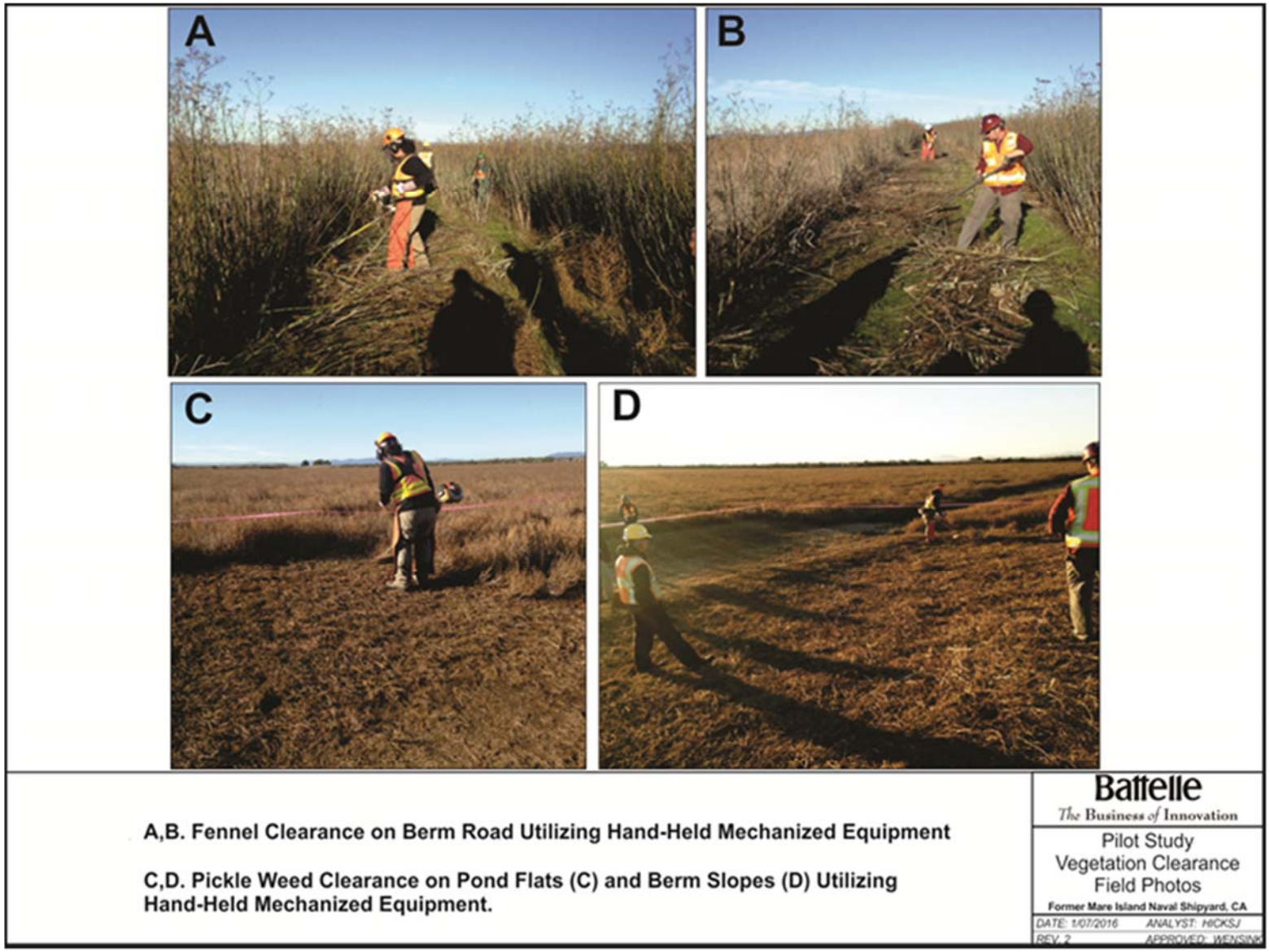

Figure 3. Pilot Study Vegetation Clearance Field Photos

Figure 4. Pilot Study Survey and Heavy Equipment Testing Field Photos

Figure 5. Proposed Revised Dredge Pond 3E and Northern MCFR Remedial Investigation Approach

Figure 6. Tractor Equipped with a Mechanical Arm and Brush Mulcher Attachment