



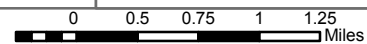
**FIGURE 01 - Vicinity Map**

REFERENCE: NWS-2011-0089-WRD (renewal)  
WQC: TBD  
PROJECT: Programmatic Piling Repair  
APPLICANT: Port of Tacoma  
LOCATION: Tacoma, WA

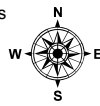
IN: Commencement Bay  
NEAR: Tacoma  
COUNTY: Pierce  
STATE: Washington

- ADJACENT LANDOWNERS:**
- 1. City of Tacoma
  - 2. City of Fife
  - 3. WSDOT
  - 4. Puyallup Tribe of Indians
  - 5. Numerous Private Landowners

SHEET: 1 OF 2  
DATE: 6/8/2018  
AUTHOR: Brian Archer



**DISCLAIMER:** The information included on this map has been compiled by Port of Tacoma staff from a variety of sources and is subject to change without notice. These data are intended for informational purposes and should not be considered authoritative for engineering, navigational, legal and other site-specific uses. The Port of Tacoma makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information.



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





**FIGURE 02: EXAMPLE WATER QUALITY MONITORING LOCATIONS**

REFERENCE: NWS-2011-0089-WRD (renewal)  
WQC: #TBD  
APPLICANT: PORT OF TACOMA

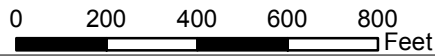
PROJECT: PROGRAMMATIC PILE REPLACEMENT  
WATER QUALITY MONITORING PLAN

**Legend**

-  Pier
-  Early Detection (75 ft)
-  Compliance Monitoring (150 ft)
-  Port Parcels
-  Point of Construction



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**PORT OF TACOMA  
MARINE MAMMAL MONITORING PLAN  
FOR PROGRAMMATIC PILE REPLACEMENT AND REPAIR ACTIVITIES**

## **INTRODUCTION**

The Port of Tacoma (Port) proposes to conduct pile replacement and repair activities (the proposed action) at 15 wharf/dock structures located in the Blair, Hylebos, and Sitcum Waterways, and in inner Commencement Bay in Tacoma, Washington (Figure 2).

The action area for the proposed action has been established based on the extent of the zones of influence from the following components of the project (Temporary Effects Areas):

- Project footprint (in-water)
- Terrestrial noise
- Underwater noise during impact pile installation (Impact Temporary Effect Area)
- Underwater noise during vibratory pile removal and installation (Vibratory Temporary Effect Area)

Noise levels during both impact pile installation and vibratory pile removal and/or installation could exceed the noise thresholds National Marine Fisheries Service (NMFS) has established for underwater disturbance of marine mammals within portions of the action area at each of the 15 sites. The Programmatic Biological Evaluation (PBE) prepared for this project states that a marine mammal monitoring plan will be implemented during pile removal and installation conducted between October 1 and February 14, to avoid impacts to marine mammals. The areas in which monitoring is proposed in this plan is dependent upon the location and type of activity being conducted (vibratory removal and/or installation, or impact installation). Some sites will not require monitoring.

## **DISCUSSION**

### **In-Water Vibratory Pile Removal and Installation**

NMFS has established an underwater noise disturbance threshold of 120 dB<sub>RMS</sub> (decibels root mean square) for non-impulse, continuous industrial noises for cetaceans and pinnipeds. Noise levels during vibratory pile removal and installation would exceed this threshold within a portion of the action area (Vibratory Temporary Effect Area) at each of the 15 sites.

The proposed action will consist of the removal and installation of up to 200 piles annual in each year of the program (July 16, 2018 – February 14, 2023). The proposed action will replace a combination of load-bearing structural piles and fender piles. Most of the piles are treated timber piles (including creosote-treated and ACZA-treated piles); however, some are concrete. The proposed action will not install creosote-treated timber piles. ACZA-treated timber piling of a similar size and diameter will replace both creosote-treated and ACZA-treated timber piling. The largest timber piling to be replaced is approximately 18 inches in diameter. Concrete piling of a similar size and diameter will replace existing concrete piling. The largest concrete piling that will

be replaced is 24 inches in diameter. Most of the piling to be replaced is less than 18 inches in diameter and the proposed action will replace no more than an estimated four concrete piles with diameters of 18 inches or greater in a single year.

New research associated with pile driving has been published since the previous permit cycle. A review of existing literature including project-specific data published by WSDOT (Laughlin 2007; 2011; 2015) California Department of Transportation's (CalTrans) Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish, which includes the Compendium of Pile Driving Sound Data (Buehler et al. 2015, CalTrans 2015), and project-specific data published by the U.S. Navy (NSWCCD 2016), indicate that 160 dB<sub>RMS</sub> is still an appropriate worst case estimate of the maximum sound levels likely to be produced during vibratory removal or installation of timber or concrete piles, for the following reasons:

- WSDOT reports that, on average, vibratory noise levels are between 10 and 20 dB lower than those produced by impact pile driving (WSDOT 2017).
- In 2015, the U.S. Navy collected hydroacoustic data during vibratory removal of timber piles and impact driving of concrete piles at Pier 6 of its naval shipyard in Bremerton. The results of this monitoring indicate that average values during vibratory removal of the timber piles ranged between 138 dB<sub>RMS</sub> and 158 dB<sub>RMS</sub>, with an overall average of 152 dB<sub>RMS</sub>. The average values during impact pile driving of 24-inch concrete piles ranged from 168 dB<sub>RMS</sub> to 183 dB<sub>RMS</sub> with an overall average of 178 dB<sub>RMS</sub> (NSWCCD 2016). The average impact noise was approximately 35 dB to 40 dB higher across the analysis bandwidth when compared to the site's quiet ambient condition (NSWCCD 2016).
- CalTrans' Compendium of Pile Driving Data provides information regarding vibratory installation of: 12-inch H-type steel pipe piles (150 dB<sub>RMS</sub>), 12-inch steel pipe piles (155 dB<sub>RMS</sub>), 24-inch AZ steel sheet pile (160 dB<sub>RMS</sub>), and 36-inch steel pipe piles (170 dB<sub>RMS</sub>) (CalTrans 2015). Concrete and timber piles produce much lower underwater sound pressures than similarly sized steel piles. Given these sound pressure levels, for purposes of this consultation, the sound pressure levels associated with vibratory removal and/or installation of 12–18-inch timber piles or 12–24-inch concrete piles would not exceed 160 dB<sub>RMS</sub> on average.

The following assumptions underlay the vibratory pile removal and installation noise attenuation analysis:

- Background in-water noise levels in the action area are not available, so the analysis used a marine mammal vibratory guideline threshold of 120 dB<sub>RMS</sub>.
- A worst-case estimate of noise level from vibratory removal and installation of concrete and timber piles is 160 dB<sub>RMS</sub>.
- Noise will attenuate at a rate of 4.5 dB per doubling distance (meters).
- Sound will stop when it reaches the nearest land mass.

The distance at which 160 dB<sub>RMS</sub> is expected to attenuate to 120 dB<sub>RMS</sub> using the practical spreading loss model is approximately 4,642 meters, or 2.9 miles.

$$R_1 = R_2 * (10^{(TL/15)}) = 10 * (10^{((160-120)/15)}) = 4,641.6 \text{ meters.}$$

Figures 3-17 show the Vibratory Temporary Effect Area for each of the 15 sites.

The Port may collect site-specific, in-water noise background data before the start of the project to determine if the monitoring can be reduced.

### **In-Water Impact Pile Installation**

NMFS has established impact pile driving underwater noise injury thresholds of 180 dB<sub>RMS</sub> for cetaceans and 190 dB<sub>RMS</sub> for pinnipeds, and impact pile driving disturbance thresholds of 160 dB<sub>RMS</sub> for both cetaceans and pinnipeds. Noise levels during impact pile installation are not expected to exceed injury thresholds for either pinnipeds or cetaceans, but will likely temporarily exceed the disturbance threshold of 160 dB<sub>RMS</sub> within a portion of the action area at each of the 15 sites (Impact Temporary Effect Area).

Data published by WSDOT indicate that impact installation of timber piles has been measured as producing underwater noise levels as high as 180 dB<sub>Peak</sub>, 170 dB<sub>RMS</sub>, and 160 dB SEL (sound exposure level) (WSDOT 2016). These same data indicate that impact installation of 36-inch concrete piles typically produces single strike sound pressure levels of 192 dB<sub>Peak</sub>, 176 dB<sub>RMS</sub>, and 174 dB SEL (WSDOT 2017). CalTrans has published project-specific data documenting lower decibel levels during impact driving of 24-inch concrete piles (188 dB<sub>Peak</sub>, 176 dB<sub>RMS</sub>, and 166 dB SEL) (CalTrans 2015); however, for purposes of making a conservative estimate of the extent of underwater noise produced, the higher decibel levels have been used to determine the extent of underwater noise.

The distance at which 176 dB<sub>RMS</sub> is expected to attenuate to 160 dB<sub>RMS</sub> using the practical spreading model is approximately 117 meters or 383 feet.

$$R_1 = R_2 * (10^{(TL/15)}) = 10 * (10^{((176-160)/15)}) = 116.6 \text{ meters.}$$

Figures 3-17 show the Impact Temporary Effect Area for each of the 15 sites.

### **SPECIES PRESENCE**

ESA-listed marine mammal species (Southern Resident killer whale and humpback whale) are not expected to be present within the Blair, Hylebos, or Sitcum Waterways at any time, and are therefore unlikely to be exposed to elevated underwater noise associated with any pile removal or installation conducted at Parcels 86, 99, and 105 (Sites 15, 13, and 14, respectively on Figures 15-17).

Additionally, pile removal or installation conducted at Washington United Terminal (WUT), Blair Dock, Pierce County Terminal (PCT), East Blair 1 (EB-1), and Puget Sound Energy (PSE) (Sites 5-8 and 12, respectively on Figures 7-10 and 14) is only expected to elevate sound levels within Commencement Bay within a small area where ESA-listed marine mammals are unlikely to be present, or within such a small area that the noise would be insignificant.

As presented in the PBE, Southern Resident killer whales and humpback whales are not expected within Commencement Bay between July 16 and September 30, and pile removal and installation conducted during this time period would not be expected to affect any ESA-listed marine mammals (Osborne 2008; Mongillo 2012). Southern Resident killer whales are most commonly observed in Commencement Bay between approximately October and January, with the greatest potential for occurrence being between December and January (Osborne 2008). Humpback whales are sighted only occasionally in south Puget Sound, and are unlikely to occur within the waters of inner Commencement Bay at any time of the year.

## **MONITORING SCHEDULE**

Marine mammal monitoring will be implemented between October 1 and February 14 to avoid impacts to ESA-listed marine mammals as determined by the PBE prepared for this proposed action. The monitoring will be implemented at the pile replacement activity-specific locations identified as Monitoring Areas and as detailed below under Monitoring Protocol.

### **MONITORING AREAS (VIBRATORY & IMPACT PILE REPLACEMENT ACTIVITY)**

The sites at which vibratory pile removal and/or installation could potentially affect ESA-listed marine mammals are West Sitcum Terminal (formerly APMT), Terminal 7, East Sitcum Terminal (formerly OCT), Husky Terminal, Washington United Terminal (WUT), Blair Dock, Parcel 115, Tote Terminal, and Trident Piers 24 and 25 (Sites 1-6 and 9-11 on Figures 3-6 and 11-13). Therefore, during any vibratory pile removal or installation conducted at these sites (Sites 1-4 and 9-11), the Vibratory Monitoring Area within the 120 dB<sub>RMS</sub> Vibratory Temporary Effect Area identified on Figures 3-6 and 11-13 will be monitored and maintained as a marine mammal buffer area. Vibratory pile removal or installation will not commence or will be suspended temporarily if any orca or humpback whale is present within the Vibratory Monitoring Area (i.e., marine mammal buffer) for the respective site at which vibratory pile replacement activities are being conducted (Sites 1-4 and 10-11).

The only site at which impact pile installation could potentially affect ESA-listed marine mammals is at Trident Piers 24 and 25 (Site 11 on Figure 13). Therefore, during any impact pile installation or proofing conducted at Site 11, the respective Impact Monitoring Area within 160 dB<sub>RMS</sub> Impact Temporary Effect Area identified on Figure 13 will be monitored and maintained as marine mammal buffer area. Impact pile installation or proofing will not commence or will be suspended temporarily if any orca or humpback whale is present within Site 11 (Figure 13) Impact Monitoring Area (i.e., marine mammal buffer).

The Port may collect site-specific in-water noise background data before the start of a pile replacement project to determine if the monitoring areas can be reduced.

### **MONITORING PROTOCOL**

The Port will conduct the following marine mammal monitoring activities during the timeframe indicated under the Monitoring Schedule, at the locations specified under Monitoring Areas and shown on the attached figures.

1. Qualified biologists or other trained marine mammal observers who meet the list of qualifications for marine mammal observers will be present on site at all times during pile removal/driving activities per the Monitoring Schedule and at the specified Monitoring Areas.
2. Two observers will monitor the Vibratory Monitoring Area as required by the Monitoring Schedule and at the specified Monitoring Areas (October 1 to February 14, at Sites 1-6 and 9-11, as shown on Figures 3-6 and 11-13). The first observer will be in the vicinity of the proposed pile replacement activity. The second observer will either be at a land-based location or on a boat traveling within the vibratory disturbance area. The most likely land-based locations for the second observer will be at a location on Browns Point, along Marine

View Drive, or along the southwestern shoreline of Commencement Bay (Schuster Parkway, Ruston Way).

3. A single observer will monitor the Impact Monitoring Area as required by the Monitoring Schedule and at the specified Monitoring Areas (October 1 to February 14 at Site 11, as shown on Figure 13).
4. The observer(s) will use binoculars and visual observation to scan the waters within the respective Monitoring Area.
5. The observer(s) will scan the waters 20 minutes before the beginning of pile removal/driving activities and during all pile removal/driving activities. The observer(s) will notify the on-site operator in charge if Southern Resident killer whales or humpback whales enter or are observed within the respective Monitoring Area 20 minutes prior or during pile driving. The operator in charge will require the contractor to not begin or to cease work until the animal has moved outside the Monitoring Area.

#### **MINIMUM QUALIFICATIONS FOR MARINE MAMMAL OBSERVERS**

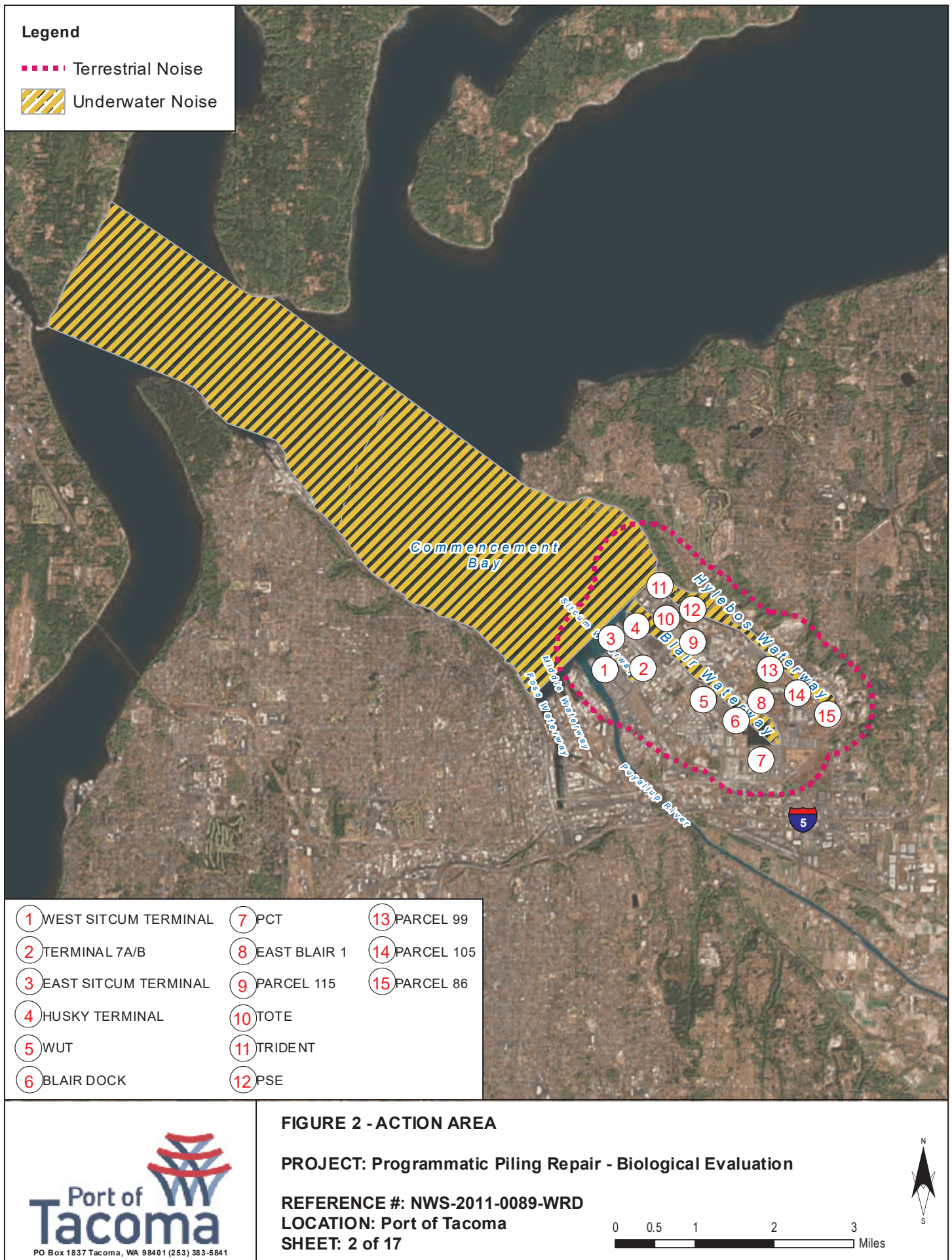
1. Visual acuity in both eyes (correction is permissible) sufficient to discern moving targets at the water's surface and to estimate target size and distance. Use of binoculars may be necessary to identify the target correctly.
2. Advanced education in biological science, wildlife management, mammalogy, or related field (bachelor's degree or higher is preferred).
3. Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
4. Experience or training in the field identification of marine mammals (cetaceans and pinnipeds).
5. Sufficient training, orientation, or experience with construction operation to preserve personal safety during observations.
6. Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.



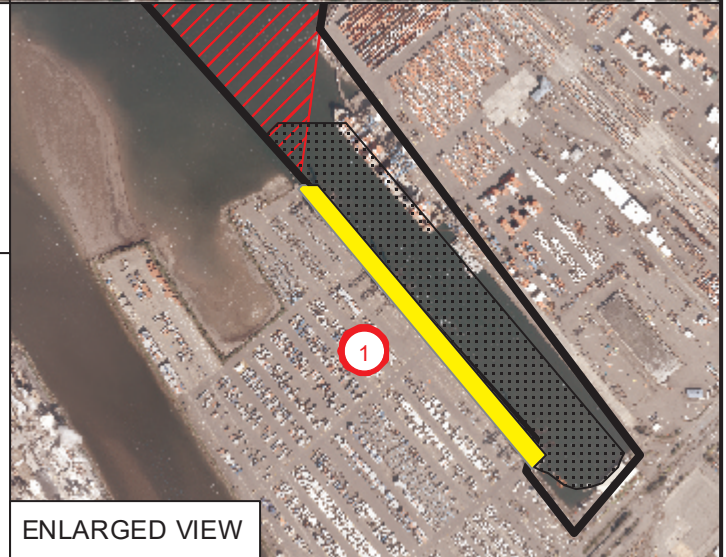
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- Site
- Vibratory Temp. Effect Area (Removal/Installation)
- Vibratory Monitoring Area (Removal/Installation)
- Impact Temp. Effect Area (Installation)
- Impact Monitoring Area (Installation)

- |  |  |   |
|--|--|---|
| <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">1</span> WEST SITCUM TERMINAL | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">7</span> PCT          | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">13</span> PARCEL 99  |
| <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">2</span> TERMINAL 7A/B        | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">8</span> EAST BLAIR 1 | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">14</span> PARCEL 105 |
| <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">3</span> EAST SITCUM TERMINAL | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">9</span> PARCEL 115   | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">15</span> PARCEL 86  |
| <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">4</span> HUSKY TERMINAL       | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">10</span> TOTE        |   |
| <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">5</span> WUT                  | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">11</span> TRIDENT     |   |
| <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">6</span> BLAIR DOCK           | <span style="border: 1px solid red; border-radius: 50%; padding: 2px;">12</span> PSE         |   |

ENLARGED VIEW



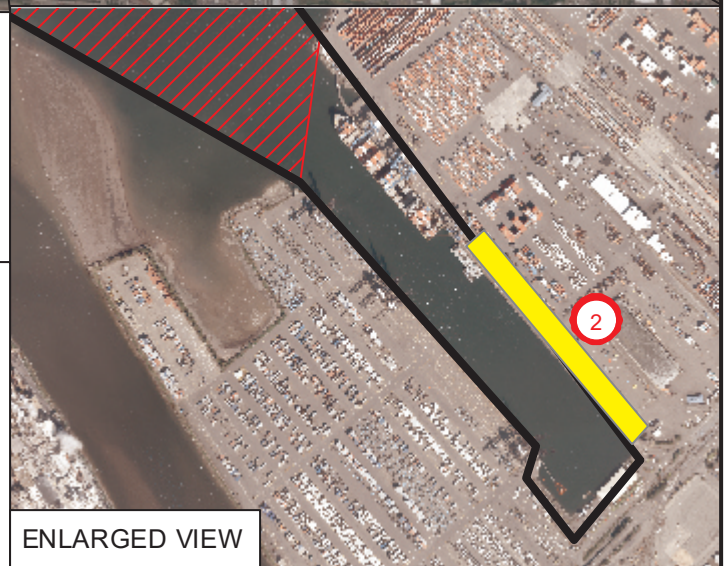
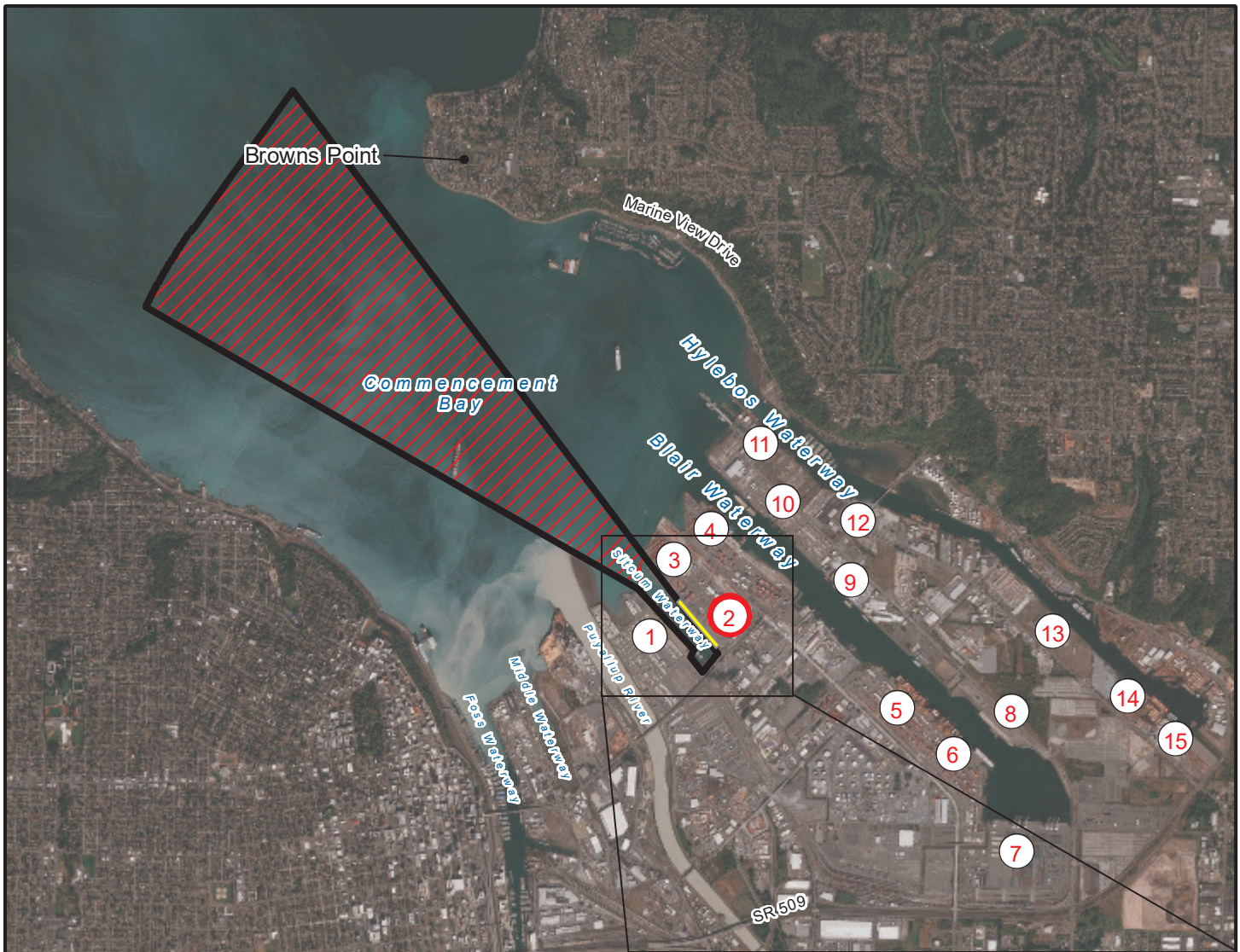
### FIGURE 3 - SITE 1

**PROJECT:** Programmatic Piling Repair - Biological Evaluation  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #:** NWS-2011-0089-WRD  
**LOCATION:** Port of Tacoma  
**SHEET:** 3 of 17

0 0.25 0.5 1 1.5  
 Miles







ENLARGED VIEW

- Site
- Vibratory Monitoring Area (Removal/Installation)
- Vibratory Monitoring Area (Removal/Installation)
- Impact Temp. Effect Area (Installation)
- Impact Monitoring Area (Installation)

- |                        |                |               |
|------------------------|----------------|---------------|
| 1 WEST SITCUM TERMINAL | 7 PCT          | 13 PARCEL 99  |
| 2 TERMINAL 7A/B        | 8 EAST BLAIR 1 | 14 PARCEL 105 |
| 3 EAST SITCUM TERMINAL | 9 PARCEL 115   | 15 PARCEL 86  |
| 4 HUSKY TERMINAL       | 10 TOTE        |               |
| 5 WUT                  | 11 TRIDENT     |               |
| 6 BLAIR DOCK           | 12 PSE         |               |

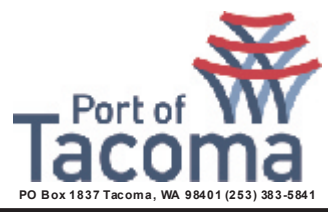
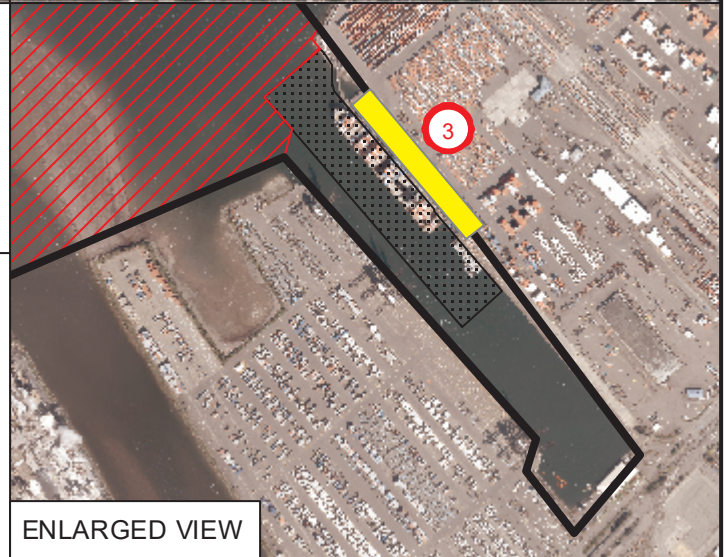
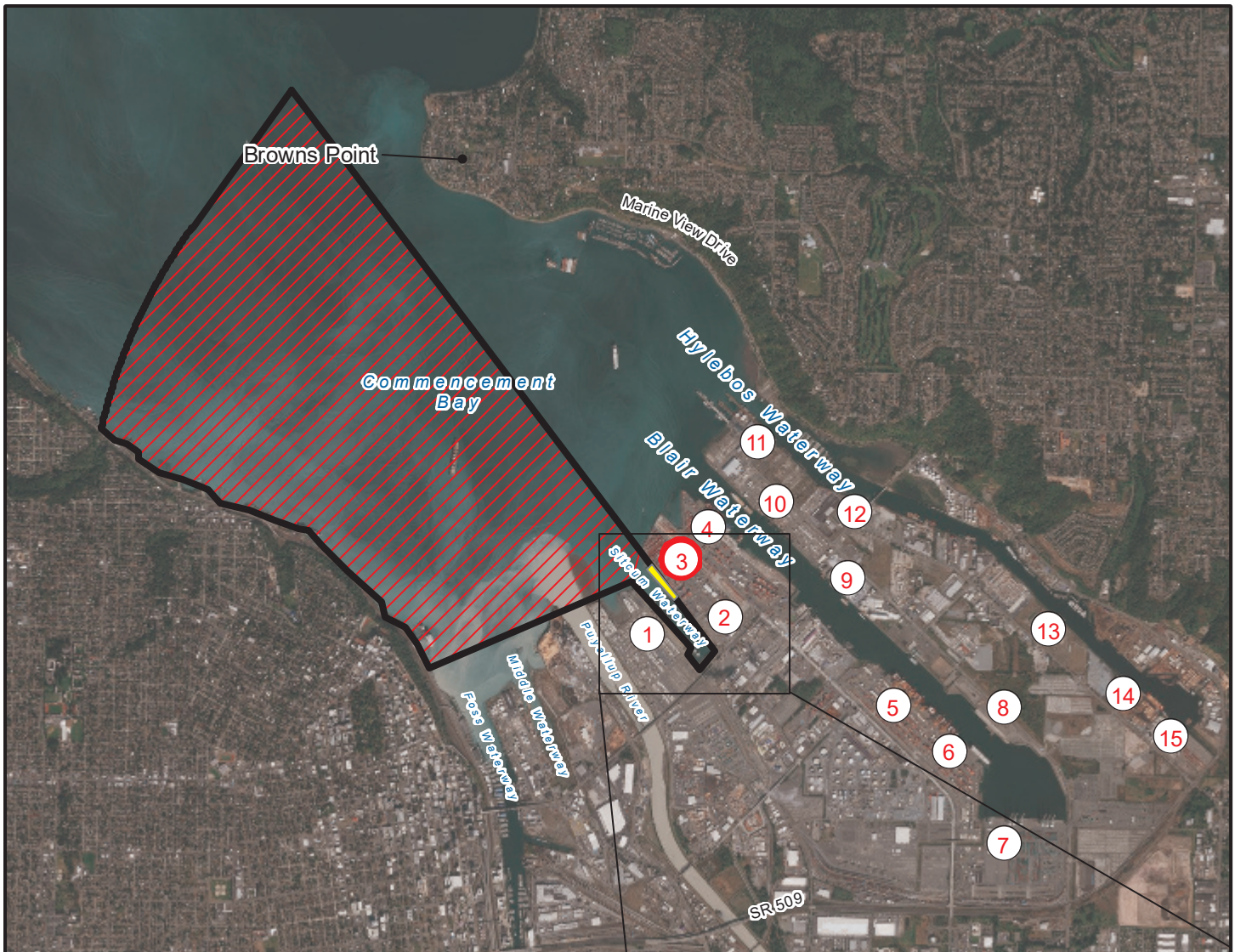







FIGURE 4 - SITE 2

**PROJECT: Programmatic Piling Repair - Biological Evaluation**  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #: NWS-2011-0089-WRD**  
**LOCATION: Port of Tacoma**  
**SHEET: 4 of 17**







-  Site
-  Vibratory Temp. Effect Area (Removal/Installation)
-  Vibratory Monitoring Area (Removal/Installation)
-  Impact Temp. Effect Area (Installation)
-  Impact Monitoring Area (Installation)

- |                        |                |               |
|------------------------|----------------|---------------|
| 1 WEST SITCUM TERMINAL | 7 PCT          | 13 PARCEL 99  |
| 2 TERMINAL 7A/B        | 8 EAST BLAIR 1 | 14 PARCEL 105 |
| 3 EAST SITCUM TERMINAL | 9 PARCEL 115   | 15 PARCEL 86  |
| 4 HUSKY TERMINAL       | 10 TOTE        |               |
| 5 WUT                  | 11 TRIDENT     |               |
| 6 BLAIR DOCK           | 12 PSE         |               |

ENLARGED VIEW

**FIGURE 5 - SITE 3**

**PROJECT: Programmatic Piling Repair - Biological Evaluation**  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #: NWS-2011-0089-WRD**  
**LOCATION: Port of Tacoma**  
**SHEET: 5 of 17**



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 Miles

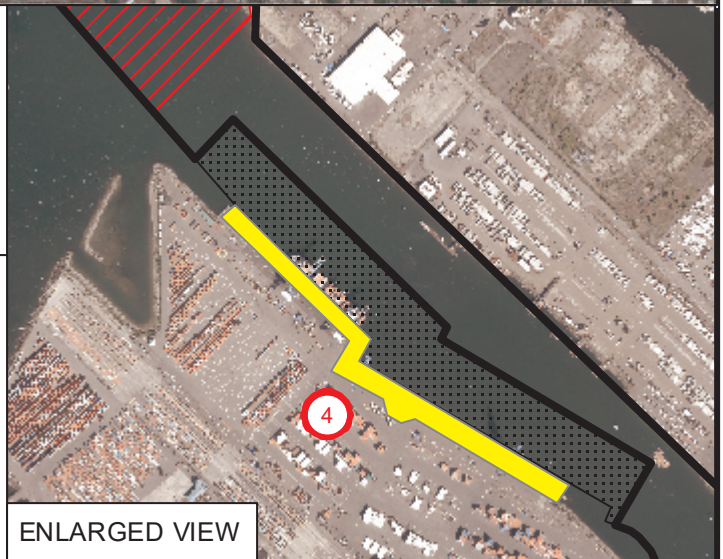






- Site
- Vibratory Temp. Effect Area (Removal/Installation)
- Vibratory Monitoring Area (Removal/Installation)
- Impact Temp. Effect Area (Installation)
- Impact Monitoring Area (Installation)

- |                        |                |               |
|------------------------|----------------|---------------|
| 1 WEST SITCUM TERMINAL | 7 PCT          | 13 PARCEL 99  |
| 2 TERMINAL 7A/B        | 8 EAST BLAIR 1 | 14 PARCEL 105 |
| 3 EAST SITCUM TERMINAL | 9 PARCEL 115   | 15 PARCEL 86  |
| 4 HUSKY TERMINAL       | 10 TOTE        |               |
| 5 WUT                  | 11 TRIDENT     |               |
| 6 BLAIR DOCK           | 12 PSE         |               |

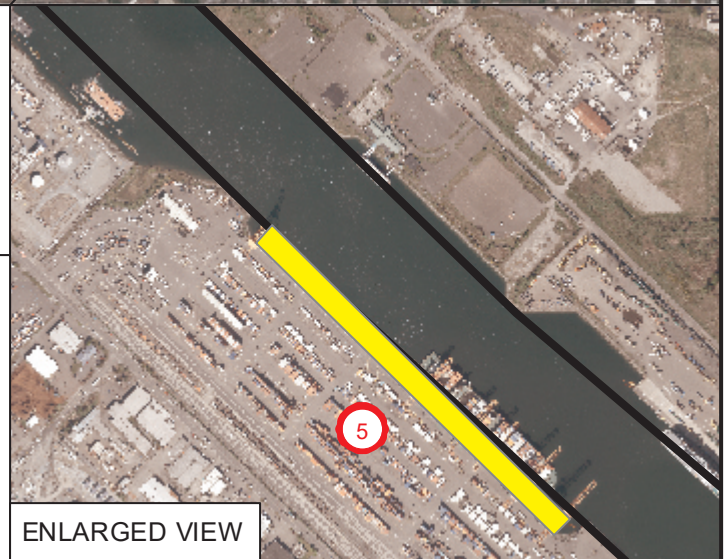


**FIGURE 6 - SITE 4**

**PROJECT: Programmatic Piling Repair - Biological Evaluation**  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #: NWS-2011-0089-WRD**  
**LOCATION: Port of Tacoma**  
**SHEET: 6 of 17**







Site Vibratory Temp. Effect Area (Removal/Installation) Vibratory Monitoring Area (Removal/Installation) Impact Temp. Effect Area (Installation) Impact Monitoring Area (Installation)		
1 WEST SITCUM TERMINAL 2 TERMINAL 7A/B 3 EAST SITCUM TERMINAL 4 HUSKY TERMINAL <b>5 WUT</b> 6 BLAIR DOCK	7 PCT 8 EAST BLAIR 1 9 PARCEL 115 10 TOTE 11 TRIDENT 12 PSE	13 PARCEL 99 14 PARCEL 105 15 PARCEL 86

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**FIGURE 7 - SITE 5**

**PROJECT: Programmatic Piling Repair - Biological Evaluation**

**Temporary Effect and Monitoring Areas**

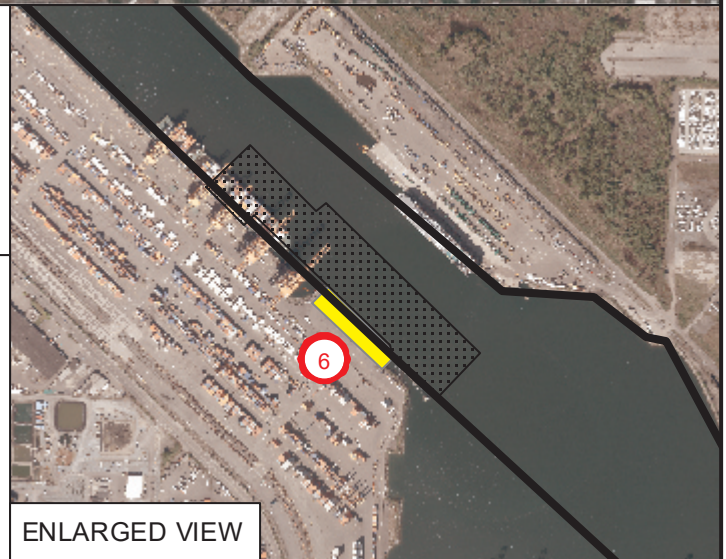
**REFERENCE #: NWS-2011-0089-WRD**






**LOCATION: Port of Tacoma**

**SHEET: 7 of 17**

0 0.325 0.65 1.3 1.95 Miles





 Site		
 Vibratory Temp. Effect Area (Removal/Installation)		
 Vibratory Monitoring Area (Removal/Installation)		
 Impact Temp. Effect Area (Installation)		
 Impact Monitoring Area (Installation)		

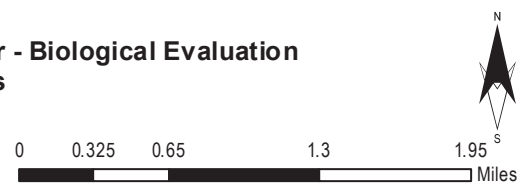
  

1 WEST SITCUM TERMINAL	7 PCT	13 PARCEL 99
2 TERMINAL 7A/B	8 EAST BLAIR 1	14 PARCEL 105
3 EAST SITCUM TERMINAL	9 PARCEL 115	15 PARCEL 86
4 HUSKY TERMINAL	10 TOTE	
5 WUT	11 TRIDENT	
6 BLAIR DOCK	12 PSE	

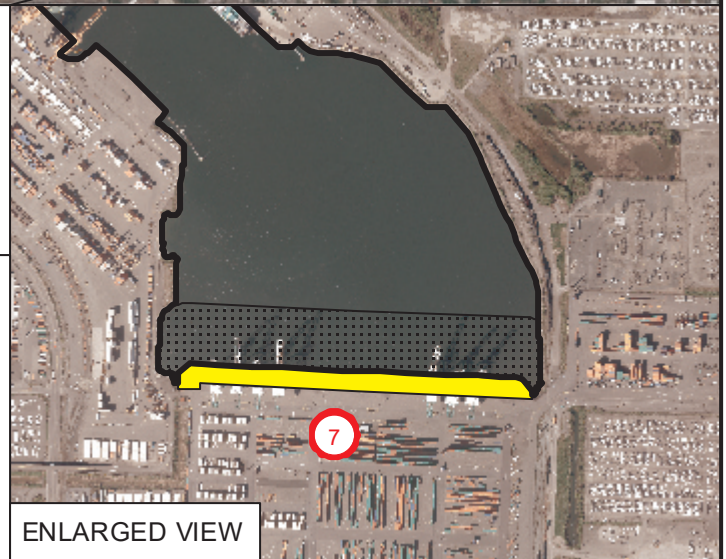
ENLARGED VIEW

FIGURE 8 - SITE 6

**PROJECT:** Programmatic Piling Repair - Biological Evaluation  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #:** NWS-2011-0089-WRD  
**LOCATION:** Port of Tacoma  
**SHEET:** 8 of 17







- Site
- Vibratory Temp. Effect Area (Removal/Installation)
- Vibratory Monitoring Area (Removal/Installation)
- Impact Temp. Effect Area (Installation)
- Impact Monitoring Area (Installation)

- |                        |                |               |
|------------------------|----------------|---------------|
| 1 WEST SITCUM TERMINAL | 7 PCT          | 13 PARCEL 99  |
| 2 TERMINAL 7A/B        | 8 EAST BLAIR 1 | 14 PARCEL 105 |
| 3 EAST SITCUM TERMINAL | 9 PARCEL 115   | 15 PARCEL 86  |
| 4 HUSKY TERMINAL       | 10 TOTE        |               |
| 5 WUT                  | 11 TRIDENT     |               |
| 6 BLAIR DOCK           | 12 PSE         |               |

ENLARGED VIEW

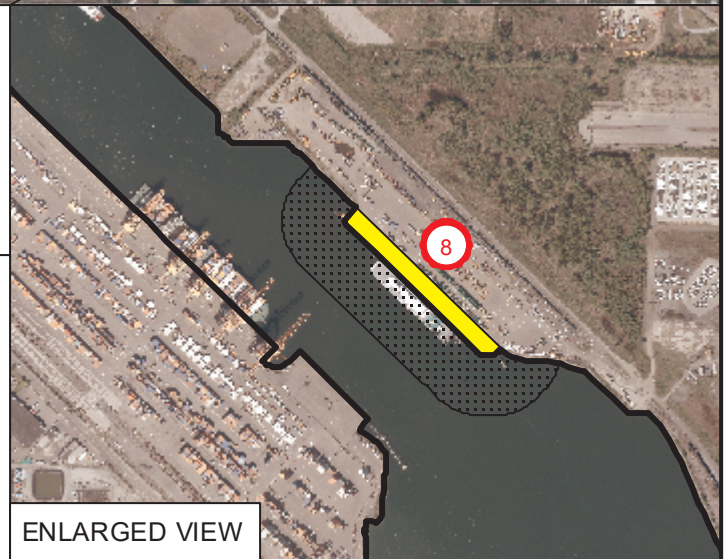


## FIGURE 9 - SITE 7

**PROJECT:** Programmatic Piling Repair - Biological Evaluation  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #:** NWS-2011-0089-WRD  
**LOCATION:** Port of Tacoma  
**SHEET:** 9 of 17







- Site
- Vibratory Temp. Effect Area (Removal/Installation)
- Vibratory Monitoring Area (Removal/Installation)
- Impact Temp. Effect Area (Installation)
- Impact Monitoring Area (Installation)

- |                        |                |               |
|------------------------|----------------|---------------|
| 1 WEST SITCUM TERMINAL | 7 PCT          | 13 PARCEL 99  |
| 2 TERMINAL 7A/B        | 8 EAST BLAIR 1 | 14 PARCEL 105 |
| 3 EAST SITCUM TERMINAL | 9 PARCEL 115   | 15 PARCEL 86  |
| 4 HUSKY TERMINAL       | 10 TOTE        |               |
| 5 WUT                  | 11 TRIDENT     |               |
| 6 BLAIR DOCK           | 12 PSE         |               |

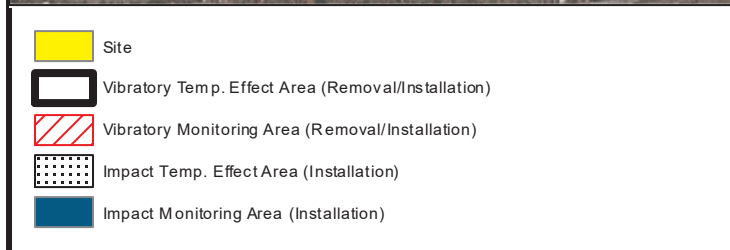


**FIGURE 10 - SITE 8**

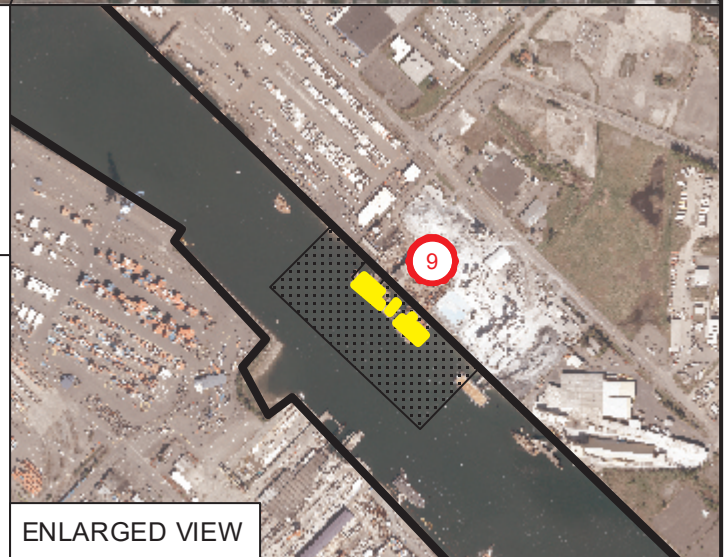
**PROJECT: Programmatic Piling Repair - Biological Evaluation**  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #: NWS-2011-0089-WRD**  
**LOCATION: Port of Tacoma**  
**SHEET: 10 of 17**







1 WEST SITCUM TERMINAL	7 PCT	13 PARCEL 99
2 TERMINAL 7A/B	8 EAST BLAIR 1	14 PARCEL 105
3 EAST SITCUM TERMINAL	9 PARCEL 115	15 PARCEL 86
4 HUSKY TERMINAL	10 TOTE	
5 WUT	11 TRIDENT	
6 BLAIR DOCK	12 PSE	

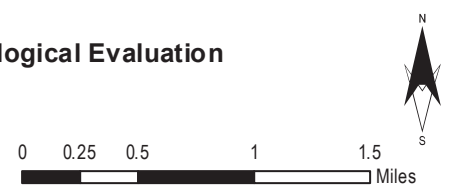


ENLARGED VIEW

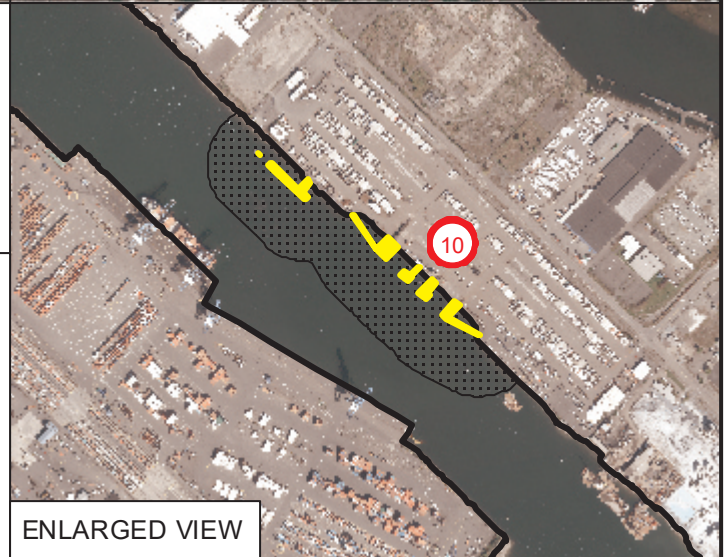


FIGURE 11 - SITE 9

**PROJECT:** Programmatic Piling Repair - Biological Evaluation  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #:** NWS-2011-0089-WRD  
**LOCATION:** Port of Tacoma  
**SHEET:** 11 of 17








1 WEST SITCUM TERMINAL	7 PCT	13 PARCEL 99
2 TERMINAL 7A/B	8 EAST BLAIR 1	14 PARCEL 105
3 EAST SITCUM TERMINAL	9 PARCEL 115	15 PARCEL 86
4 HUSKY TERMINAL	10 TOTE	
5 WUT	11 TRIDENT	
6 BLAIR DOCK	12 PSE	

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**FIGURE 12 - SITE 10**



**PROJECT: Programmatic Piling Repair - Biological Evaluation**

**Temporary Effect and Monitoring Areas**

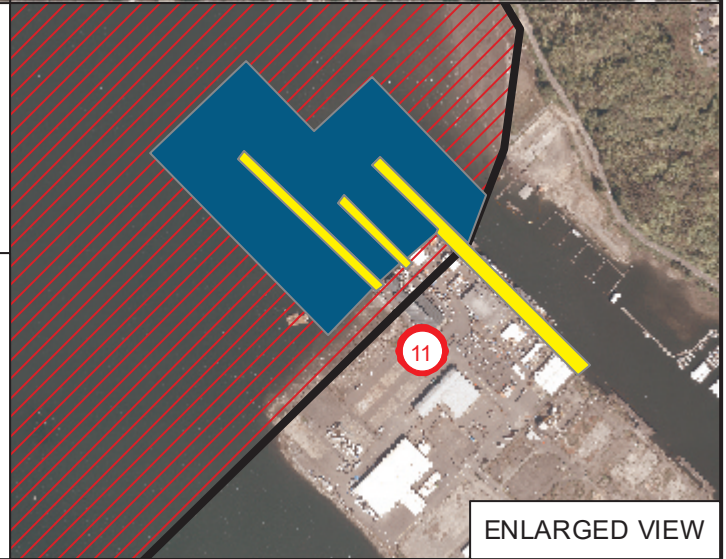
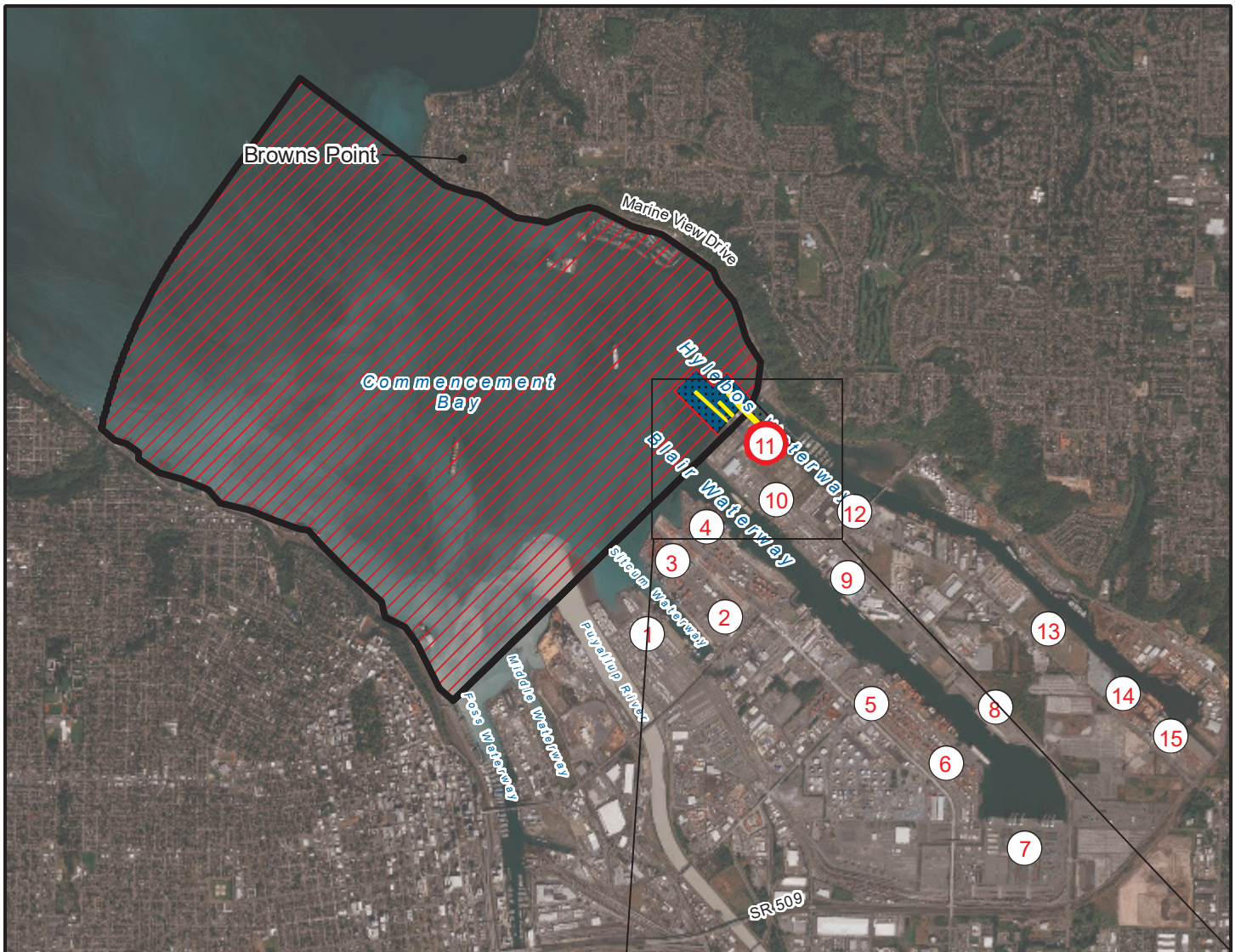
**REFERENCE #: NWS-2011-0089-WRD**

**LOCATION: Port of Tacoma**

**SHEET: 12 of 17**





- Site
- Vibratory Temp. Effect Area (Removal/Installation)
- Vibratory Monitoring Area (Removal/Installation)
- Impact Temp. Effect Area (Installation)
- Impact Monitoring Area (Installation)

- |                        |                |               |
|------------------------|----------------|---------------|
| 1 WEST SITCUM TERMINAL | 7 PCT          | 13 PARCEL 99  |
| 2 TERMINAL 7A/B        | 8 EAST BLAIR 1 | 14 PARCEL 105 |
| 3 EAST SITCUM TERMINAL | 9 PARCEL 115   | 15 PARCEL 86  |
| 4 HUSKY TERMINAL       | 10 TOTE        |               |
| 5 WUT                  | 11 TRIDENT     |               |
| 6 BLAIR DOCK           | 12 PSE         |               |



**FIGURE 13 - SITE 11**

**PROJECT: Programmatic Piling Repair - Biological Evaluation**  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #: NWS-2011-0089-WRD**  
**LOCATION: Port of Tacoma**  
**SHEET: 13 of 17**







1 WEST SITCUM TERMINAL	7 PCT	13 PARCEL 99
2 TERMINAL 7A/B	8 EAST BLAIR 1	14 PARCEL 105
3 EAST SITCUM TERMINAL	9 PARCEL 115	15 PARCEL 86
4 HUSKY TERMINAL	10 TOTE	
5 WUT	11 TRIDENT	
6 BLAIR DOCK	12 PSE	



**FIGURE 14 - SITE 12**

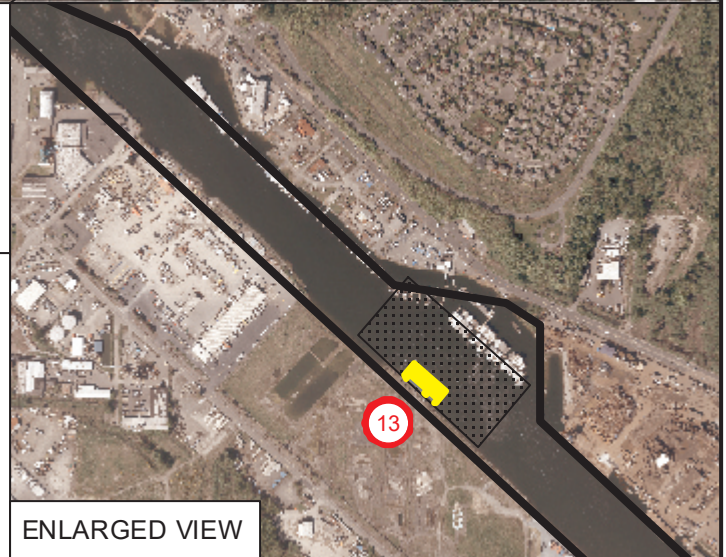
**PROJECT: Programmatic Piling Repair - Biological Evaluation**  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #: NWS-2011-0089-WRD**  
**LOCATION: Port of Tacoma**  
**SHEET: 14 of 17**








1 WEST SITCUM TERMINAL	7 PCT	13 PARCEL 99
2 TERMINAL 7A/B	8 EAST BLAIR 1	14 PARCEL 105
3 EAST SITCUM TERMINAL	9 PARCEL 115	15 PARCEL 86
4 HUSKY TERMINAL	10 TOTE	
5 WUT	11 TRIDENT	
6 BLAIR DOCK	12 PSE	



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**FIGURE 15 - SITE 13**


**PROJECT: Programmatic Piling Repair - Biological Evaluation**


**Temporary Effect and Monitoring Areas**

**REFERENCE #: NWS-2011-0089-WRD**

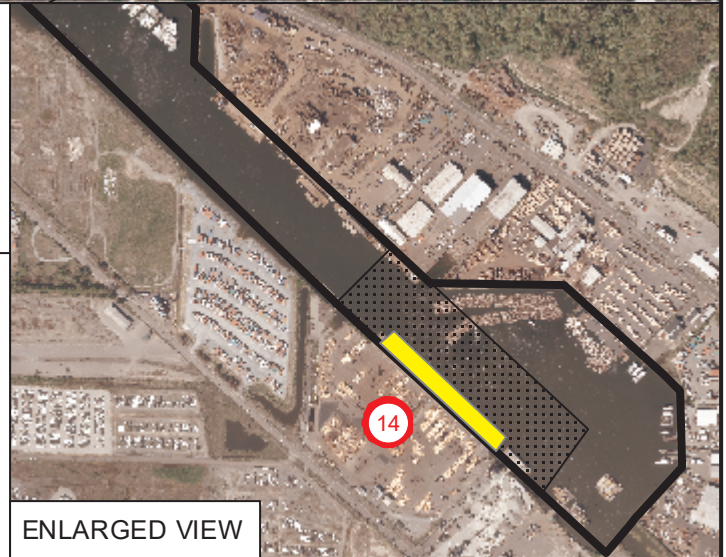
**LOCATION: Port of Tacoma**

**SHEET: 15 of 17**









ENLARGED VIEW

- Site
- Vibratory Temp. Effect Area (Removal/Installation)
- Vibratory Monitoring Area (Removal/Installation)
- Impact Temp. Effect Area (Installation)
- Impact Monitoring Area (Installation)

- |                        |                |               |
|------------------------|----------------|---------------|
| 1 WEST SITCUM TERMINAL | 7 PCT          | 13 PARCEL 99  |
| 2 TERMINAL 7A/B        | 8 EAST BLAIR 1 | 14 PARCEL 105 |
| 3 EAST SITCUM TERMINAL | 9 PARCEL 115   | 15 PARCEL 86  |
| 4 HUSKY TERMINAL       | 10 TOTE        |               |
| 5 WUT                  | 11 TRIDENT     |               |
| 6 BLAIR DOCK           | 12 PSE         |               |

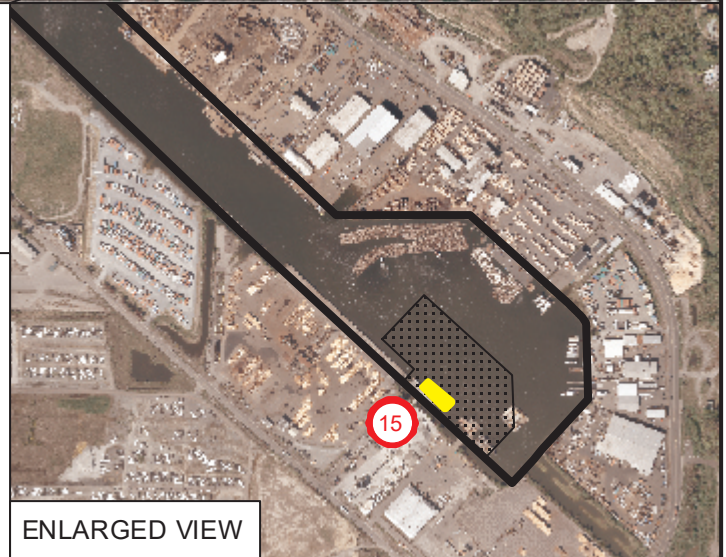


FIGURE 16 - SITE 14

**PROJECT: Programmatic Piling Repair - Biological Evaluation**  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #: NWS-2011-0089-WRD**  
**LOCATION: Port of Tacoma**  
**SHEET: 16 of 17**







-  Site
-  Vibratory Temp. Effect Area (Removal/Installation)
-  Vibratory Monitoring Area (Removal/Installation)
-  Impact Temp. Effect Area (Installation)
-  Impact Monitoring Area (Installation)

- |                        |                |               |
|------------------------|----------------|---------------|
| 1 WEST SITCUM TERMINAL | 7 PCT          | 13 PARCEL 99  |
| 2 TERMINAL 7A/B        | 8 EAST BLAIR 1 | 14 PARCEL 105 |
| 3 EAST SITCUM TERMINAL | 9 PARCEL 115   | 15 PARCEL 86  |
| 4 HUSKY TERMINAL       | 10 TOTE        |               |
| 5 WUT                  | 11 TRIDENT     |               |
| 6 BLAIR DOCK           | 12 PSE         |               |



**FIGURE 17 - SITE 15**

**PROJECT: Programmatic Piling Repair - Biological Evaluation**  
**Temporary Effect and Monitoring Areas**  
**REFERENCE #: NWS-2011-0089-WRD**  
**LOCATION: Port of Tacoma**  
**SHEET: 17 of 17**

