2012 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS OPERABLE UNIT 1 FORMER FORT ORD, CALIFORNIA

Prepared for:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Contract No. DACA45-03-D-0029
Delivery Order CM01

Prepared by:

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February 2013

HydroGeoLogic, Inc

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACL	aquifer cleanup level
COC	contaminant of concern
DD&A	Denise Duffy and Associates, Inc.
FDA	Fire Drill Area
FONR	Fort Ord Natural Reserve
GIS	geographic information system
GPS	global positioning system
GWETS	groundwater extraction and treatment system
ft^2	square feet
HGL	HydroGeoLogic, Inc.
LTM	long term monitoring
NWTS	Northwest Treatment System
OU	operable unit
ROD	Record of Decision
RTE	rare, threatened, or endangered
TCE	trichloroethene
UCNRS	University of California Natural Reserve System
UCSC	University of California at Santa Cruz
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

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2012 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS OPERABLE UNIT 1 FORMER FORT ORD, CALIFORNIA

1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) was contracted by the U.S. Army Corps of Engineers (USACE)–Sacramento District to conduct a Fixed-Price Remediation with Insurance scope of work for Operable Unit (OU)-1 at the former U.S. Army Base Fort Ord located in Monterey County, California. This work was contracted in December 2003 by the USACE–Omaha District, under Contract Number DACA45-03-D-0029, and was administered through the USACE–Sacramento District. The overall goal of this effort is to achieve the primary remediation objectives specified in the Record of Decision (ROD) signed in July of 1995 by the U.S. Army, U.S. Environmental Protection Agency, and the California Environmental Protection Agency (U.S. Army, 1995). Those remediation goals are as follows:

- Establish hydraulic control and contain contaminated groundwater.
- Extract and treat groundwater exceeding aquifer cleanup levels (ACLs).

A groundwater extraction and treatment system (GWETS) was constructed in 1988 to remediate trichloroethene (TCE) and other groundwater contaminants.

A key factor affecting the design and implementation of the groundwater cleanup is that the area including and surrounding the OU-1 contaminant plume is part of the University of California Natural Reserve System (UCNRS), which is designated as the Fort Ord Natural Reserve (FONR). The FONR area potentially affected by the construction of OU-1 remediation facilities and activities is approximately 130 acres. Therefore, the project has the additional constraint that activities undertaken to achieve the OU-1 cleanup adequately protect and maintain the critical habitat and protected species found within the FONR. The FONR is managed by staff at the University of California at Santa Cruz (UCSC).

Figure 1.1 illustrates the location of Former Fort Ord and the OU-1 source area. The source area was the former Fort Ord Fritzsche Army Airfield Fire Drill Area (FDA). Activities conducted at the FDA between 1962 and 1985 resulted in contaminants being released to soils and groundwater. Although 10 volatile organic compounds have been identified as contaminants of concern (COCs) in groundwater underlying the FDA, TCE is the contaminant detected at the highest concentrations and across the greatest extent of the affected aquifer. Data show that the footprint of the TCE plume encompasses the extent of contamination contributed to by the other nine COCs. Figure 1.2 shows the estimated extent of the TCE plume in September 2012.

The U.S. Army consulted with the U.S. Fish and Wildlife Service (USFWS) in 1998 to assess potential impacts to the sand gilia (*Gilia tenuiflora ssp. arenaria*) and Monterey spineflower (*Chorizanthe pungens var. pungens*) populations resulting from groundwater investigation and remediation activities within the FONR. The opinion was issued on 30 March 1999. The Army

consulted the USFWS again in 2002 and 2007 to address impacts to Monterey spineflower critical habitat and the California tiger salamander (*Ambystoma californiense*) (USFWS, 2002 and 2007). Various mitigation measures were identified as a result of these consultations and are implemented before, during, and after work within the FONR.

Intermittent biological surveys were conducted within the OU-1 area by others since 1998 (Harding Lawson Associates, 1998). While delivery order CM01 was being executed, HGL conducted annual biological surveys focusing on mapping the extent and population of federally protected rare, threatened, or endangered (RTE) plant species within the FONR, including the endangered sand gilia and the threatened Monterey spineflower. The findings of these surveys were submitted in the following reports:

- Appendix A of the *Draft Remedial System Modification Plan, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California* (HGL, 2004a)
- *Results of 2004 Monterey Spineflower and Sand Gilia Surveys, OU-1, Former Ft. Ord, California* (HGL, 2004b)
- *Results of 2005 Monterey Spineflower and Sand Gilia Surveys, OU-1, Former Ft. Ord, California* (HGL, 2005)
- *Final 2006 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL 2007a)
- *2007 FONR Impact Assessment and Habitat and Rare Plant Survey Results* (HGL, 2008a)
- *2008 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL, 2009a)
- *2009 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL, 2009b)
- *2010 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL, 2011a)
- *2011 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL, 2012a)

This document presents the results of the 2012 rare plant survey and discusses the potential impact to date on those plants associated with the OU-1 remediation activities conducted since 2004. The 2012 rare plant survey was conducted by Denise Duffy and Associates (DD&A) under subcontract to HGL; DD&A completed the 2006 through 2011 surveys as well. The following information also is included in this report:

- A description of the FONR site and overview of past activities,
- Descriptions of the actions taken and site management protocols implemented to minimize adverse impacts to the FONR habitat,
- A summary of the site activities conducted by HGL during 2012 and planned future activities, and
- Results of the 2012 rare plant survey and interim impact assessment.

1.1 SITE DESCRIPTION

Fort Ord was established in 1917 as a military training base for infantry troops. In January 1991, the U.S. Secretary of Defense announced the downsizing/closure of the base. In August 1994, portions of the property were transferred to UCSC, and the FONR was established in June 1996. The former Fort Ord is located near Monterey Bay, approximately 80 miles south of San Francisco. The base consists of approximately 28,000 acres near the cities of Seaside, Sand City, Monterey, Del Rey Oaks, and Marina. Monterey Bay marks the western boundary of the former Fort Ord. Toro Regional Park borders the base to the southeast and land use to the east is primarily agricultural.

OU-1 occupies approximately 590 acres of the FONR in the southwestern corner of the former Fritzsche Army Airfield, west of Imjin Road and north of Reservation Road. The dominant habitats within the OU-1 portion of the FONR are coast live oak woodland, coastal scrub, maritime chaparral and annual grassland. The maritime chaparral is considered a rare habitat by the California Department of Fish and Game. The overall former Fort Ord area contains large areas of maritime chaparral habitat.

Several federally protected RTE species are known or suspected to be present within the FONR. These include the endangered sand gilia, the threatened Monterey spineflower, and the threatened California tiger salamander. Several plant and animal species of concern are also present in the FONR. Other plant species of concern include the following:

- Coast wallflower (*Erysimum ammophilum*);
- Eastwood's ericameria (*Ericameria fasciculata*);
- Monterey ceanothus (*Ceanothus cuneatus var. rigidus*);
- Sandmat manzanita (*Arctostaphylos pumila*); and
- Toro manzanita (*Arctostaphylos montereyensis*).

The California black legless lizard (*Anniella pulchra nigra*), coast horned lizard (*Phrynosoma coronatum*), and the Monterey ornate shrew (*Sorex ornatus salarius*) are animal species of concern.

The northern boundary of OU-1 is adjacent to a large expanse of privately owned, non-native grassland. Transmission of non-native grass species into OU-1 is accelerated by the prevailing southern winds, which blow the seeds into the OU-1 area (Fusari, 2004). Non-native grasses and weedy forbs are already present throughout much of the OU-1 area. The significant expansion of these non-native grasses could cause federally listed plant populations to decline.

Sand gilia appears to be less tolerant of competing plant cover than the Monterey spineflower. This hypothesis is based on the observation that numerous small Monterey spineflower populations were identified within the dense grassland habitat bordering the main FONR habitat to the east and north or on the roadways bordering this grassland in the initial 1998 survey. Subsequent rare plant surveys conducted between 2004 and 2007 also observed Monterey spineflower in this region. Although sand gilia was not detected in this region during the 1998 through 2007 surveys, sand gilia population patches were observed in 2007 at open areas within a small zone of grassland species inside the more extensive oak woodland habitat near the OU-1

plume source area (sand gilia patches 20 through 22 appear on Figure A3.4 in Appendix A of the 2007 FONR Impact Report [HGL, 2008]). The small open area in which the sand gilia population was observed is approximately 300 feet east of the source area and is bordered by grasses that are surrounded by oak woodland and understory habitat. Several Monterey spineflower populations also were observed thriving within dense patches of non-native grasses in the same vicinity.

1.2 OVERVIEW OF OU-1 REMEDIATION ACTIVITIES WITHIN THE FONR

Numerous wells and soil borings were constructed within the FONR as part of the investigative effort to define the extent of environmental contamination and remediate contamination. Table 1.1 lists the wells that were installed within the OU-1 portion of the FONR. Table 1.2 lists the soil borings that were drilled within the FONR portion of OU-1 between 2004 and 2011 without constructing a well. Table 1.2 also lists the wells that were destroyed during that period. Figure 1.3 illustrates the OU-1 well and soil boring locations. No new wells or soil borings have been constructed by HGL within the FONR since 2006. In September 2011, 53 wells were destroyed within the FONR. Figure 1.4 illustrates the layout and components of the OU-1 groundwater remediation system within the FONR as of September 30, 2012.

Note that typical well identification formats—"MW-" prefix for monitoring wells, "EW-" prefix for extraction wells, and "IW-" prefix for injection wells—do not correspond to well function in all cases. The boundaries of the contaminated groundwater zone in OU-1 were refined as the remedial design progressed. The initial system performance pilot test and other field tests provided data that described potential pumping rates for several wells. These data were used during design of the FONR component. Formulating and evaluating design alternatives showed that the most effective OU-1 remedy required that some wells be used for different purposes than originally intended. Consequently, some wells that were intended and named as monitoring wells (MW-OU1-46-AD, MW-OU1-85-A, and MW-OU1-87-A) became extraction wells. Conversely, numerous wells with the EW- prefix have been used only for monitoring groundwater quality. Only the following EW- prefix wells have been used for groundwater extraction:

EW-OU1-60-A	EW-OU1-63-A	EW-OU1-71-A
EW-OU1-62-A	EW-OU1-66-A	

Several wells were named as potential injection well sites but only two (IW-OU1-73-A and IW-OU1-74-A) were connected to the Northwest Treatment System (NWTS) for this purpose. The rest of the "IW-" prefix wells have been used only for monitoring groundwater quality, with one exception: well IW-OU1-10-A was converted to an extraction well in October 2010.

1.3 SUMMARY OF SITE ACTIVITIES

In 1987, about 4,000 cubic yards of contaminated soils were excavated and replaced with clean fill. The OU-1 ROD (U.S. Army, 1995) indicated that remediation of the contaminated soils at the FDA was complete; the ROD also defined groundwater extraction and treatment as the selected remedy for OU-1 groundwater. A GWETS was constructed in 1988 to remediate TCE and other related groundwater contaminants. The 1988 GWETS consisted of extraction wells EW-OU1-17-A and EW-OU1-18-A and was located a short distance downgradient (north) of the

FDA. Extracted groundwater was piped to a treatment facility located at the former FDA, where dissolved organic compounds were removed using granular activated carbon vessels. The treated effluent was spray-irrigated in the southern portion of the FDA.

Despite a steady overall decline in contaminant levels within the groundwater capture zone of the 1988 GWETS, COCs were subsequently detected at concentrations above ACLs in groundwater downgradient from the capture zone. Additional wells installed between 1997 and 2001 (MW-OU1-21-A through MW-OU1-46-A) revealed that TCE exceeded the ACL as far as 2,100 feet downgradient from the existing capture zone. Groundwater modeling showed that contaminated groundwater north and west of extraction well EW-OU1-17A was not captured by the extraction system (AHTNA, 2003).

The HGL remediation contract was awarded in December 2003. A draft design to expand the original GWETS was presented in the *Draft Remedial System Modification Plan* (HGL, 2004a). New wells were installed and aquifer testing began in 2004 and continued through 2007. The draft GWETS expansion design was adjusted as data from the newly installed wells and aquifer testing were processed; the final design was issued in the three-volume Final Engineering Design Report in 2006 (HGL, 2006a; 2006b; and 2006c).

In 2006, the first component of the GWETS expansion, the *Hydraulic Control Pilot Project* (HGL, 2006d), was constructed. Four additional extraction wells (the FONR system) were constructed from July through September 2007 to further expand the GWETS. These construction activities are described in detail in the *Final Hydraulic Control Pilot Project Construction Report* (HGL, 2007b) and the *Draft FONR System Construction Report* (HGL, 2008b). Additional details concerning the GWETS expansion and a summary of OU-1 site activities conducted during 2007 relating to habitat monitoring and impacts were provided in the *2007 FONR Impact Assessment and Habitat and Rare Plant Survey Results* (HGL, 2008a).

During 2010, HGL conducted sampling activities and constructed an underground pipeline and underground powerline within the FONR habitat area. The underground pipeline and powerline connected IW-OU1-10-A to the terminus of the existing remediation system (at extraction well MW-OU1-87-A). The underground piping was laid within the existing roadway to minimize environmental impacts to the surrounding habitat. Converting IW-OU1-10-A to an extraction well has accelerated the overall groundwater cleanup. The design parameters for this expansion are described in the Remediation System Expansion Design Technical Memorandum (HGL, 2010). The 2010 construction activities and associated environmental monitoring are described in the *IW-OU1-10-A System Expansion Construction Report* (HGL, 2011b).

During 2011, activities conducted by HGL within the FONR habitat area included sampling activities, the 2011 rare plant survey, and destroying 55 monitoring wells (53 of which are located within the FONR). The 2011 well destruction activities are described in the *Well Destruction Report* (HGL, 2011c).

HGL conducted the following activities during 2012 within the FONR habitat area:

- Collected performance monitoring samples from eight extraction wells and from the NWTS;

- Collected samples from the wells composing the OU-1 groundwater long term monitoring (LTM) network;
- Performed the 2012 rare plant survey; and
- Repaired erosion and traffic rut conditions on FONR roads.

Only light-duty vehicles (pickup trucks or sedans) were used for sampling activities, and travel routes were limited to established roadways. A water truck, sheep's foot compaction roller, bobcat, and a backhoe were used during road repair. All vehicles traveled only on existing roadways to the well sites.

In addition to the HGL activities listed above, UCSC performed weed control activities in selected areas (see Appendix B). The following sections describe the 2012 activities and the 2012 rare plant survey.

1.3.1 2012 Rare Plant and Habitat Surveys

DD&A conducted surveys for sand gilia and Monterey spineflower on 16, 17, and 18 April 2012. The timing of the survey was intended to correspond with the plants' peak blooming period (late April to early May). Survey dates were determined through communications with UCSC natural resource staff and by observing Monterey spineflower and sand gilia populations in the reference area near the FONR. The 2012 rare plant survey covered three areas:

- The reference area near the intersection of Reservation Road and Imjin Parkway,
- The roadway and access route leading to well IW-OU1-10-A where construction occurred during 2010, and
- Those well sites within the FONR habitat area where wells was destroyed in September 2011.

Section 2.0 of this report presents an overview of the biological survey results, and Appendix A provides a detailed description.

1.3.2 2012 Sampling Activities

During 2012, HGL did not conduct drilling, construction, or aquifer testing activities within OU-1. Groundwater samples were collected during 2012 from many of the existing wells within the FONR as part of the OU-1 groundwater LTM program. As the remediation effort progresses, the number of wells included in the LTM network decreases and the monitoring frequency is reduced at others. Before 2009, wells included in the LTM network were typically sampled on a quarterly, semiannual, or annual basis. The quarterly sampling usually occurred in March, June, September, and December of each year. In 2009, the LTM sampling program was modified and samples from individual wells are now collected only on a semiannual or annual basis. Performance monitoring samples originally were collected at the NWTS on a bimonthly basis, but in 2010 the sampling frequency was decreased to quarterly and in 2012 sampling was reduced to a semiannual frequency.

Previous results from the groundwater quality monitoring program showed that cleanup targets within the capture zone of the original GWETS extraction wells (Figure 1.4) were achieved during 2005. Groundwater pumping and treatment from the existing GWETS area was suspended in February 2006 as part of the rebound evaluation. A rebound evaluation to assess whether the improved groundwater quality could be sustained without additional remediation was completed during 2007. The *Draft Rebound Evaluation Report* (HGL, 2007c) was submitted for regulatory review and it was agreed that the groundwater sampling frequency in this region can be greatly reduced. Sampling from selected groundwater monitoring wells in this region continued for some wells at a reduced frequency into 2011. Sample results confirmed that groundwater quality meets the ACLs and all wells within this area were destroyed in September and October 2011.

Based on the cleanup progress, HGL and regulatory agencies agreed to reduce the groundwater pumping and sampling efforts in 2012 within the interior portion of the OU-1 FONR area. Pumping and sampling along the northwest boundary continued at the same rate and schedule. The decreased pumping and sampling in the interior portion of the OU-1 FONR reduced the number of site visits and vehicle miles traveled on FONR roads, thereby reducing the potential impact to the FONR habitat.

In 2012, LTM samples and NWTS performance samples were collected in March and September. Table 1.3 summarizes the 2012 LTM and NWTS sampling events conducted at each of the OU-1 wells. At some wells only water level measurements are taken.

Groundwater elevations are measured semiannually at most wells within the OU-1 LTM network and are taken either concurrently with or within a few days of sample collection. Groundwater measurements collected from wells that are no longer sampled also are listed in Table 1.3.

1.3.3 2012 Road Erosion and Road Repair Activities

Road erosion and repair activities were conducted by Reber Construction from 15 to 19 October 2012 and on 2 November 2012 for the roads associated with OU-1 at Former Fort Ord. The repair activities were timed to avoid the peak blooming period (late April to early May). The erosion and road rut conditions were restored to the original grade, including filling or leveling ruts caused by previous site activities. The locations of the OU-1 roadway repair areas are provided on Figure 1.5. Before and after photographs of the roadways are provided on Figure 1.6.

HGL submitted a Natural Resource Protection Plan developed in accordance with the Habitat Management Plan (U.S. Army, 1997) and with input from the UCNRS management. The subcontractor performed the road erosion and road repair activities in compliance with the Natural Resource Protection Plan and the Habitat Management Plan.

1.4 IMPACT PREVENTION AND MITIGATION MEASURES

Activities conducted within the FONR are limited to those that are essential to achieving the remediation goals for the project. The remedial actions and ongoing operation of the remedial system have been and will continue to be consistent with the various biological opinions and

guidance regarding mitigation measures. Compliance with these measures reduces or avoids impacts to RTE species of concern on the project site. Guidance for the remedial design and action(s) are as follows:

- The 30 March 1999 *Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-99-F/C-39R) and supporting documentation, such as Enclosure 2 to the request for consultation* (Harding Lawson Associates, 1998);
- The 22 October 2002 *Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California, as it affects Monterey spineflower Critical Habitat*, (USFWS, 2002);
- The 14 March 2005 *Biological Opinion on the Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields* (USFWS, 2005);
- The 1 June 2007 *Amendment to Biological Opinion 1-8-04-F-25R, Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields* (USFWS, 2007);
- Guidance and direction from UCNRS staff; and
- *Installation-Wide Multispecies Habitat Management Plan* (U.S. Army, 1997).

To avoid or minimize impact to the FONR during ecologically sensitive periods (defined as the rainy season, which typically ranges from November to April), construction is sequenced to avoid this time frame as much as possible within the overall project constraints. For example, the final FONR system construction began in July 2007 and was completed in September 2007 before the seasonal rains began. Likewise, the well destruction and road repair activities were performed in September and October and completed before the rainy season began.

In addition to complying with the guidance listed above, beginning in 2007, HGL subcontracted with UCSC to implement manual and mechanical weed control measures at selected locations within the OU-1 portion of the FONR. The weed control program has been renewed annually and implemented by UCSC through 2012. UCSC staff began weed control treatments on 29 March 2012 and continued through 17 July 2012. Each area included in the weed control program received between one and three treatments (using a weed-eater and/or hand pulling) depending on site-specific phenology, observed response to past treatments, and species composition. UCSC staff also surveyed well sites to identify the composition of the plant population in the immediate vicinity of the wells. UCSC prepared a report that describes and summarizes their efforts regarding weed control and plant surveys; the report describing the 2012 weed control program is included as Appendix B.

The objectives of the weed control activities are as follows:

- Cut down or remove undesirable vegetation from areas disturbed by past OU-1 construction activities—particularly those completed during 2004 through 2006—before such vegetation released seeds into the environment.
- Prevent or reduce the expansion of non-native plants into areas disturbed by construction related to OU-1 activities.

- Prevent the occurrence of unacceptable impacts to the Monterey spineflower and sand gilia populations within that portion of the FONR affected by OU-1 remediation activities.

Figure 1.7 illustrates the locations where weed control measures were performed. During 2012, weed control consisted of cutting the weeds using manual methods (hand pulling, clipping) and mechanical devices (such as powered string trimmers or similar, easily portable equipment) as described in Appendix B. Herbicides or similar poisons have not been used as part of this effort in any year. Disposal of cut weeds was dependent on both the plant species and the timing of the weed cutting episode. Cut weeds were left on the ground if there was no danger that the seeds would germinate and sprout after cutting; otherwise, the cut weeds were bagged and removed from the site for proper disposal. The species subject to weed control included plant species that are listed as a noxious weed by the California Department of Food and Agriculture, included on invasive plant lists maintained by the California Invasive Plant Council, or considered to be a problematic species by the UCSC FONR natural resource staff.

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2.0 OVERVIEW OF 2012 RARE PLANT SURVEY RESULTS

The objectives of the 2012 rare plant survey and habitat inventory were to accomplish the following:

1. Identify locations and estimate rare plant populations at an identified reference site and at FONR well destruction sites, and at sites where construction for the remediation system took place; and
2. Map Monterey spineflower and sand gilia populations for comparison to past surveys and to facilitate planning if future construction or maintenance activities are needed.

The reference site encompasses approximately one-half acre located approximately 3,000 feet southeast of the former OU-1 source area. DD&A biologists have used this site for several years to identify the peak of the blooming period for Monterey spineflower and sand gilia. The time to initiate the rare plant surveys at former Fort Ord and other locations has been based, in part, on observations of plants within the reference area to ensure that such surveys are conducted at appropriate times.

Coast live oak woodland is the dominant habitat in the reference area. Grassland and coast live oak woodland is adjacent to the reference site on the northwestern boundary. All other sides of the reference area are bordered by developed roads (Reservation Road, Mbest Drive, and University Drive). Non-native grasses and weedy forbs are already present throughout much of the reference area.

The 2012 rare plant survey was conducted at the reference site, along the IW-OU1-10-A pipeline route, and at 35 well sites within OU-1. This section presents a summary of the key findings from those surveys. The complete survey report is presented in Appendix A.

A DD&A biologist and a DD&A technician conducted surveys for sand gilia and Monterey spineflower on 16, 17, and 18 April 2012 using a global positioning system (GPS). The survey was timed to coincide with the peak blooming period insofar as possible. The peak blooming period was determined through communications with UCSC FONR natural resource management staff and by observing a known occurrence of sand gilia at the Fort Ord reference site near the FONR.

Each of the rare plant surveys was conducted along existing or proposed roadways and access routes. When rare plants were absent, the width of the survey area was approximately 10 feet beyond the edge of the roadway on either side. If a rare plant was identified, the survey in that area was extended to the boundary of the population encountered.

2.1 RARE PLANT SURVEY METHODS

Large areas of Monterey spineflower and sand gilia were mapped as polygons using a Trimble Pathfinder ProXH GPS unit. Smaller plant groups and individuals were mapped as points with attributes to identify the number of individuals at each location. When a rare plant was identified, the survey in that area was extended to the boundary of the population encountered.

Individual counts were made for all sand gilia populations whether they were mapped as points (population less than five) or polygons (population greater than five). The polygon boundary was drawn to include all plants identified as a distinct population. However, Monterey spineflower was only counted as individuals when groups of less than five were mapped. For larger populations, Monterey spineflower was mapped as polygons and characterized according to the percent of cover; specifically, the percentage of the polygon covered by the Monterey spineflower divided by the total area enclosed within the polygon. The cover classes are defined as follows:

- Very Sparse (corresponding to an absolute cover of less than 3 percent);
- Sparse (3 to 25 percent);
- Medium Low (26 to 50 percent);
- Medium (51 to 76 percent);
- Medium High (76 to 97 percent); and
- Very High (greater than 97 percent).

GPS data were exported to a shapefile format for use in a geographic information system (GIS) (ESRI ArcGIS) and mapped on high-resolution aerial photography. These maps are presented in Appendix A (Figures A3.1, A3.2, and A3.3).

2.2 SAND GILIA SURVEY RESULTS

Sand gilia was observed and mapped at the DD&A reference site and at 9 of the 40 well sites. A total of 60 populations (38 points and 22 polygons) of sand gilia were mapped within the 2012 survey area (see Appendix A Table A3.1 and Figures A3.1, A3.2, and A3.3). A total of 1,052 individual plants were mapped at the 60 populations.

2.3 MONTEREY SPINEFLOWER SURVEY RESULTS

A total of 43 populations (8 points and 35 polygons) of Monterey spineflower were mapped at the reference site and at 21 of the 40 well sites within the FONR (Table A3.2 and Figures A3.1, A3.2, and A3.3 in Appendix A). Because Monterey spineflower population size estimates are not as easily quantified as the sand gilia populations, individual Monterey spineflower plants were not counted within the GIS polygons. Populations of Monterey spineflower were estimated as a percentage of the overall ground cover using visual estimation. Of the 35 populations of Monterey spineflower that were mapped as polygons, five populations had a Medium Low cover class (26 to 50 percent cover), and 30 populations were identified as Sparse (3 to 25 percent cover).

3.0 DISCUSSION OF 2012 SURVEY RESULTS

As noted earlier, the 2012 rare plant survey area overlapped the previous surveys only at those wells that were destroyed in 2011 and at IW-OU1-10-A. Most of the destroyed wells were installed before the year 2000 and were not disturbed during the construction efforts completed from 2004 through 2010. Consequently, the destroyed wells were not included in the OU-1 rare plant surveys conducted between 2007 and 2010. The 2011 rare plant survey was conducted in April and included the well sites that were subsequently destroyed in October. Thus, the 2012 survey results may be compared only to the pre-destruction observations made in April 2011 and the results of previous surveys from 1998 through 2007 in nearly all cases.

The annual reference plot rare plant survey was initiated in 2010. Table 3.1 summarizes the survey results at the reference plot. Table 3.2 summarizes the results for all rare plant surveys conducted within the OU-1 footprint since 1998. This section focuses on comparing the 2012 survey and 2011 survey results. Section 4.0 compares the 2012 rare plant survey results with the 1998 through 2012 dataset.

During well construction or destruction activities, the work area and drill rig footprint is approximately 30 feet in diameter and centered on the well borehole. Discussions comparing survey results in this report assume that a plant population or polygon is attributed to a given well site if any part of the population or polygon is within the potentially disturbed area. In some cases, observation wells were constructed within approximately 30 feet of an existing well. For the purpose of this impact assessment, these locations are considered and counted as a single location and data point.

Numerous environmental factors affect the growth of the rare plants monitored in this survey. Precipitation is an important factor, particularly during the rainy season that typically occurs from late October through May. The annual rare plant surveys are timed to coincide with the peak blooming season and are typically performed in April or May. The total precipitation for the October through March period preceding the annual rare plant survey is provided in Table 3.3 for reference in subsequent discussions.

Fifty-three wells were destroyed in the FONR in 2011. Thirty-seven of the destroyed wells were located at 32 sites within the FONR habitat area and were included in the 2012 rare plant survey. In addition, the IW-OU1-10-A / PZ-OU1-10-A1 well pair is considered to be one site and was included in the survey as part of the 3-year post-construction monitoring that began after IW-OU1-10-A was converted to an extraction well in 2010. The remaining destroyed wells were located in the grassland portion of the FONR or in grassland outside the FONR property and are therefore not included in any rare plant surveys at OU-1. The overview of survey results presented in Section 3.0 is thus based on the 2012 survey results at 33 sites (including 39 wells) within the FONR habitat as compared to the 2011 survey results. Section 4.0 presents a comprehensive overall review of the 2004 through 2012 rare plant data for all wells within the FONR habitat area.

3.1 SAND GILIA

Within the FONR area surveyed, sand gilia populations were observed in more locations than Monterey spineflower populations for the second consecutive year. In each OU-1 rare plant survey performed from 2004 through 2007, Monterey spineflower populations were observed in more locations (no rare plant surveys were conducted from 2008 through 2010 within the 2012 survey area). Because of the significant differences in rainfall and in the size of the 2007 versus 2012 survey areas, as well as the complexity of environmental factors affecting sand gilia, it is not possible to assess the significance of the greater number of sand gilia locations in comparison to Monterey spineflower locations.

3.1.1 Reference Area

In 2011, 16 populations totaling 318 individual sand gilia (four polygons and 12 points) were mapped within the DD&A reference area. In 2012, 16 populations totaling 70 individual sand gilia (four polygons and 12 points) were mapped within the DD&A reference area. Table 3.1 summarizes the results for years 2011 and 2012. The sand gilia polygons covered 1,409.5 square feet (ft^2) in 2011, and decreased by 85 percent to approximately 209.6 ft^2 in 2012 (a decrease of 1,199.9 ft^2).

The most significant change in sand gilia cover was located in the middle of the reference area (see Figure A3.1 in Appendix A). Sand gilia observed during the 2012 survey effort was substantially less when compared to the 2011 survey effort. The October 2011 through March 2012 rainfall totaled 11.3 inches and was significantly less than the 17.3 inches recorded in 2011. This difference in rainfall may have affected the sand gilia population. The reference area is located on property that is relatively undisturbed by anthropogenic activities. The decrease in plant population is therefore assumed to represent natural variation and may indicate that any decreases in sand gilia population within the OU-1 construction areas in 2012 are related to environmental factors rather than potential construction impacts.

3.1.2 Destroyed Well Sites

Sand gilia was found in 2011 at 9 of the 33 sites surveyed before well destruction activities were performed (Table 3.2). At eight of these nine sites, sand gilia also was found in the 2012 survey, indicating no adverse impact to the plant population between 2011 and 2012. At one site (EW-OU1-54-A), sand gilia was identified before the well destruction activity but not after. However, at two sites (MW-BW-10-A and MW-OU1-01-A) sand gilia was not observed before the destruction activity but was found afterward. Overall, sand gilia was found at 9 sites in the 2011 pre-destruction survey and at 10 sites in the 2012 post-destruction survey. Together with the observed decline in sand gilia at the reference site, these data support the conclusion that the well destruction activities did not impact sand gilia populations in the survey area.

3.2 MONTEREY SPINEFLOWER

Previous rare plant surveys conducted by DD&A indicate that populations of Monterey spineflower were often observed in areas with sparse to moderately abundant non-native annual grass cover, suggesting that this species may be somewhat more tolerant of annual grass cover

variations and environmental factors than sand gilia. Although sand gilia populations were observed more often than Monterey spineflower in 2012, both species were widespread in the 2011 and 2012 surveys.

3.2.1 Reference Area

One population (Sparse polygon) of Monterey spineflower was mapped at the DD&A reference site in 2011. Three Monterey spineflower populations (two Sparse polygons and one point) were mapped within the DD&A reference area in 2012. Table 3.1 summarizes the results. The total area covered by Monterey spineflower in the reference area was nearly identical from 2010 to 2011 (approximately 2,850 ft^2) with a difference of 19.3 ft^2. The difference of 1,371.9 ft^2 between 2011 and 2012 was substantially greater than the change from 2010 to 2011 and represents a 48 percent decrease in the polygon area. There are several environmental factors that affect the amount of Monterey spineflower that blooms in a given year. Because the reference site is relatively undisturbed, it is likely that the environmental factors supporting Monterey spineflower growth were not as pronounced in 2012 as compared to the previous 2 years.

3.2.2 Destroyed Well Sites

Monterey spineflower was found in 2011 at 24 of the 33 sites surveyed before well destruction activities were performed (Table 3.2). At 20 of these 24 sites, Monterey spineflower also was found in the 2012 survey, indicating no adverse impact to the plant population between 2011 and 2012. At four sites (MW-OU1-02-A, MW-OU1-04-A, MW-OU1-20-A, and EW-OU1-54-A), Monterey spineflower was identified in the 2011 survey before the well destruction activity but not after. However, at three of these four sites (MW-OU1-04-A, MW-OU1-20-A, and EW-OU1-54-A), Monterey spineflower was not present in the baseline 1998 or 2004 surveys.

At the EW-OU1-18-A/ PZ-OU1-16-A co-located site, Monterey spineflower was not observed in the 2011 survey before the destruction activity but was found afterward—this was the first observation of Monterey spineflower at this location since it was reported in the 1998 and 2004 surveys. The site was included in three previous annual surveys (it was not detected in 2005, 2006, or 2011). Other than foot traffic to collect samples, the destruction activity was the first disturbance at this location since before the 1998 survey was conducted. Thus, the 2012 occurrence may indicate a potential beneficial impact on Monterey spineflower. Together with the observed decline in Monterey spineflower at the reference site, these observations and data support the conclusion that the well destruction activities did not impact Monterey spineflower populations in the survey area.

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4.0 IMPACT ASSESSMENT AND CONCLUSIONS

Construction efforts were undertaken by HGL during the 2004 through 2012 time period to remediate contaminated groundwater within the OU-1 portion of the FONR. Construction activities included the following:

- Drilling soil borings;
- Constructing extraction, injection, and monitoring wells;
- Installing water conveyance pipelines;
- Installing infiltration trenches;
- Constructing a groundwater treatment facility;
- Converting IW-OU1-10-A from a monitoring well to an extraction well;
- Destroying 53 wells within the FONR; and
- Road repair to address ruts created by heavy equipment traffic and erosion.

Figure 4.1 illustrates the areas in which construction occurred during 2004 through 2012. The locations of wells destroyed in 2011 are shown on Figure 4.2.

A critical concern throughout the project has been the protection of the rare plant species within the FONR. To that end, direct impacts of construction activities within the footprint of known populations of Monterey spineflower or sand gilia were minimized by using the results of the 1998 rare plant survey (Harding Lawson Associates, 1998). The results of the 1998 rare plant survey are provided on Figure 4.3. In addition, a pre-construction survey was conducted in the spring of 2004 (HGL, 2004b) to delineate population locations. The survey results were used to adjust the location of remediation facilities to avoid previously identified rare plant locations wherever possible. As discussed below, this strategy enabled the construction activity to avoid overlapping known rare plant populations except in a few cases as described later in this section.

UCSC staff responsible for the management of the FONR expressed a significant concern that construction activities would cause indirect impacts to the rare plant species by altering the habitat in the work areas. They were concerned that the practice of clearing existing native vegetation to enable equipment access for well or pipeline construction may provide a pathway for non-native, invasive plant species from the surrounding areas to encroach farther into the FONR. The UCSC concern is that such encroachment may result in declining rare plant populations as the non-native newcomers out-compete the existing plants and come to dominate the overall species distribution. To address this concern, HGL has conducted annual rare plant surveys from 2004 through 2012 (through subcontractors) and conducted habitat surveys in 2006 and 2007. The data resulting from these surveys are evaluated annually and have not shown evidence of significant impact to rare plant populations.

In addition, HGL has contributed funds to support manual and mechanical weed control efforts by UCSC from 2007 through 2012. The most recent effort is described in detail in Appendix B. UCSC is confident that the weed abatement efforts are having a positive impact on reducing weed populations on the OU-1 cleanup sites and, very importantly, have removed a large portion of the invasive weed seed source for the 2012 growing season.

Table 3.2 summarizes the rare plant populations observed at the OU-1 well sites. To date, the survey results show that the impact-minimization and abatement efforts and proactive construction management techniques employed throughout the construction effort to mitigate impacts have been successful in minimizing the impact to rare plant populations. The data from Table 3.2 are discussed in the following sections.

In total, 108 wells were installed as part of the investigation and remediation of contaminated groundwater within the OU-1 portion of the former Fort Ord boundary. Twenty-five of these wells were constructed in the grassland area that borders the critical FONR habitat. These 25 wells were not included in the rare plant surveys because the grassland area is not suitable habitat for Monterey spineflower or sand gilia. One well was installed at the same location to replace a damaged well (MW-OU1-24AR replaced MW-OU1-24-A) and thus the 108 well total double-counts that well location. Well MW-OU1-12-A was destroyed before the 2004 survey and the area was not included in subsequent surveys.

Multiple wells were constructed within approximately 30 feet of one another at eight locations and, in these cases, the group of wells was considered to be a single site for the purpose of evaluating the rare plant survey results. Forty-five new OU-1 wells were constructed at forty-two new well locations within the FONR between 2004 and 2006. Several wells constructed between 1986 and 2002 also were co-located. The following sets of wells are counted as a single location because they are within 30 feet of each other.

- MW-OU1-46-AD and PZ-OU1-46-AD2;
- EW-OU1-49-A and PZ-OU1-49-A1;
- IW-OU1-10-A and PZ-OU1-10-A1;
- IW-OU1-02-A and PZ-OU1-02-A;
- EW-OU1-17-A, PZ-OU1-13-A, and PZ-OU1-14-A;
- EW-OU1-18-A, PZ-OU1-15-A, and PZ-OU1-16-A;
- MW-OU1-29-A and PZ-OU1-35-A; and
- MW-OU1-32-A and MW-OU1-33-A.

After excluding individual wells as noted above, rare plant population data were evaluated for 74 well locations and at 3 equipment staging areas used during the 2004 construction activities—77 total sites. The following sections discuss the evaluation results of the rare plant surveys conducted from 1998 through 2012.

4.1 OPERABLE UNIT 1 IMPACTS ON MONTEREY SPINEFLOWER

Evaluation of the data showed that these 77 total locations fall into five categories:

- Monterey spineflower not detected before or after construction (26 locations);
- Monterey spineflower detected before but not after construction (8 locations);
- Monterey spineflower detected before and after construction (11 locations);

- Monterey spineflower not detected before construction but was detected after construction (13 locations); and
- The well was constructed before the initial rare plant survey in 1998 (19 locations).

The rare plant survey results with respect to Monterey spineflower are discussed in the following subsections.

4.1.1 Monterey Spineflower Not Detected Before or After construction

Approximately 34 percent of the sites fell within this category (26 of the 77 total). These data cannot be used to assess site-specific impacts.

4.1.2 Monterey Spineflower was Detected Before but Not After Construction

There were only eight locations where the 1998 or 2004 rare plant survey identified Monterey spineflower populations that were not observed at least once in subsequent surveys:

- MW-OU1-25-A
- MW-OU1-40-A
- EW-OU1-49-A/ PZ-OU1-49-A1
- MW-OU1-57-A
- EW-OU1-60-A
- EW-OU1-66-A
- MW-OU1-61-A
- MW-OU1-65-A

At six of the eight locations where previously existing Monterey spineflower populations were identified in 1998, the wells were constructed along the roadways bordering the adjacent grasslands to the north and east. The rare plant populations in these areas are considered of marginal value because they are adjacent to grassland habitat that is unsuitable for sustaining the rare plant species (HGL, 2006b). HGL discussed these proposed well locations with UCSC management staff before construction began to confirm that the potential disruption of these plant populations was an acceptable approach and would not present a significant impact. These six well locations were as follows:

- EW-OU1-49-A/ PZ-OU1-49-A1
- MW-OU1-57-A
- EW-OU1-60-A
- EW-OU1-66-A
- MW-OU1-61-A
- MW-OU1-65-A

Of the six wells listed above, only wells EW-OU1-49-A/ PZ-OU1-49-A1 were surveyed in 2004. The other five wells were surveyed from 2005 through 2007. Plant surveys were not performed at these six well sites after 2007, except at EW-OU1-60A and MW-OU1-61-A, which also were surveyed in 2008. Annual rare plant surveys at these wells were stopped after 2008 because 3 years of monitoring had been completed. Monterey spineflower was not detected at these locations during the surveys completed in 2005, 2006, and 2007. It is not possible to conclude that the absence of these populations—since their detection in 1998—is the result of the construction activity because their location is adjacent to grassland areas and is susceptible to varying environmental conditions. Natural variables, including precipitation (Table 3.3), may be responsible for the lack of detected populations in post-construction surveys. In any case, these

populations are of marginal value given that they are present within the edge of the grassland habitat.

Monterey spineflower was observed in 1998 at the site of two future wells (MW-OU1-25-A and MW-OU1-40-A); MW-OU1-25-A was installed in 1998 and MW-OU1-40-A was installed in 1999. There was no activity other than sampling in this area thereafter. Given the population variability observed at the undisturbed reference plot, the data are inconclusive concerning the impact of construction activity on the Monterey spineflower population. Also, the fact that the 1998 data represented a "great year" for Monterey spineflower and sand gilia (UCSC, 2006) suggest that natural variability rather than construction impacts may be the reason it was not found in subsequent surveys.

4.1.3 Monterey Spineflower was Detected Before and After Construction

There were 11 locations where the 1998 or 2004 rare plant survey identified Monterey spineflower populations that also were observed at least once in subsequent surveys. This group makes up approximately 33 percent of the sites that identified Monterey spineflower in any survey between 1998 and 2012. The data provided below indicate that OU-1 remediation activities did not impact Monterey spineflower populations at these sites.

Location	Number of pre-construction survey detections	Number of post-construction surveys	Number of post-construction survey detections
MW-OU1-39-A	2	2	2
MW-OU1-44-A	1	2	2
MW-OU1-46-A	1	6	3
MW-OU1-46-AD*	1	5	2
EW-OU1-53-A	1	3	2
IW-OU1-01-A	1	5	4
IW-OU1-25-A	1	4	2
MW-OU1-50-A	1	5	4
MW-OU1-56-A	1	3	1
Staging Area #1	1	3	2
Staging Area #2	1	3	3

*Indicates results for all co-located wells.

Additional survey results are provided in Table 3.2.

4.1.4 Monterey spineflower was Not Detected Before But was Detected After Construction

The rare plant survey results indicated potentially beneficial impacts on Monterey spineflower populations at 13 sites where this species was not observed before the OU-1 remediation activities beginning in 2004 but was detected in post-construction surveys. The site locations and data are summarized below:

Location	Number of pre-construction surveys (no detections)	Number of post-construction surveys	Number of Monterey spineflower detections
MW-OU1-32-A*	2	2	2
MW-OU1-38-A	2	3	2
EW-OU1-54-A	2	5	2
EW-OU1-55-A	2	5	2
IW-OU1-05-A	2	4	4
IW-OU1-24-A	2	4	3
MW-OU1-59-A	1	3	1
Staging Area #3	2	3	2
EW-OU1-71-A	2	4	1
IW-OU1-74-A	1	5	3
MW-OU1-82-A	1	5	2
MW-OU1-83-A	2	5	2
MW-OU1-84-A	1	5	2

*Indicates results for all co-located wells.

These data suggest that the site disturbances from remediation activities had a potentially beneficial effect on Monterey spineflower conditions. Additional survey results details are provided in Table 3.2.

4.1.5 Well Was Constructed Before the Initial Rare Plant Survey

Monterey spineflower was observed in one or more rare plant surveys from 1998 through 2011 at 19 locations where wells were constructed before the 1998 survey was performed. Because these wells pre-date the earliest available survey results from 1998, it is not known whether rare plants were present before the wells were constructed. In total, 25 wells were constructed at 21 locations before the 1998 survey. One well was located within the source area and those soils were excavated and replaced with non-native fill. Thus, Monterey spineflower was observed at a detection frequency of 95 percent (19 out of 20 native soil locations) in these wells.

Monterey spineflower was not detected in any survey at 25 of the 57 total locations constructed after 1998—thus, 32 detections were observed for a 56 percent detection frequency. As noted earlier, the 1998 rare plant survey represented a “great year” for Monterey spineflower and sand gilia (UCSC, 2006). Because pre-construction rare plant populations are unknown at these locations, it is not possible to make site-specific comparisons to the post-construction rare plant survey results. However, the fact that Monterey spineflower was found at 95 percent of the well locations in this category versus 56 percent for later wells supports the conclusion that no adverse impact to plant populations occurred as a result of OU-1 remediation activities.

4.2 OPERABLE UNIT 1 IMPACTS ON SAND GILIA

As above, the 77 total well locations and staging areas fall into five categories:

- Sand gilia was not detected in any survey (54 locations);

- Sand gilia was detected before but not after construction (3 locations);
- Sand gilia was detected before and after construction (2 locations);
- Sand gilia was not detected before construction but was detected after construction (6 locations); and
- The well was constructed before the initial rare plant survey in 1998 (12 locations).

The rare plant survey results with respect to sand gilia are discussed in the following subsections.

4.2.1 Sand Gilia Not Detected Before or After Construction

Approximately 70 percent of the sites fell within this category (54 of the 77 total). These data cannot be used to assess site-specific impacts but they suggest that sand gilia is not widespread within the OU-1 portion of the FONR.

4.2.2 Sand Gilia was Detected Before but Not After Construction

There were only three locations where the 1998 or 2004 rare plant survey identified sand gilia populations that were not observed at least once in subsequent surveys:

- IW-OU1-25-A;
- Staging Area #3; and
- MW-OU1-44-A.

At well IW-OU1-25-A, sand gilia was observed in the 2004 survey but was absent in the 1998 survey. Sand gilia was not observed at this location in post-construction surveys from 2005 through 2006 and in 2011 or 2012. As noted previously, 1998 presented optimum environmental conditions to promote rare plant growth. Given the absence of sand gilia at this location in 1998 and the population variability observed at the undisturbed reference plot, the data are inconclusive concerning the effect of construction activity on the sand gilia population.

At Staging Area #3, a similar situation occurred but the years were reversed—sand gilia was observed in the 1998 survey but was absent in the 2004 survey. Sand gilia was not observed at this location in post-construction surveys from 2005 through 2006. Because there was no activity in this area after 2004, it was not included in subsequent surveys. Given the absence of sand gilia in 2004 at this location and the population variability observed at the undisturbed reference plot, the data are inconclusive concerning the impact of construction activity on the sand gilia population. Again, 1998 presented optimum environmental conditions for the sand gilia (UCSC, 2006). The fact that the sand gilia was not found in the pre-construction survey of 2004 also suggests that natural variability—rather than construction impacts—may be the reason the species was not found in the 2005 through 2007 surveys.

Well MW-OU1-44-A was installed in 2000. There was no activity other than sampling in this area thereafter. Consequently, it was not included the 2004 survey or in post-construction rare plant surveys until 2011, when it was scheduled to be destroyed. Consequently, there are only three data points for comparison at this site—the very favorable condition year of 1998 and years 2011 and 2012. In 2012, the total rainfall during the October through March period preceding the

survey was 11.3 inches (Table 3.3). This total is 3 inches less than the average total of the 10-year database and approximately 11 inches less than the 1998 total. Because of the limited data at this site and the wide variation in rainfall conditions, the data are inconclusive concerning the impact of construction activity on the sand gilia population.

4.2.3 Sand Gilia was Detected Before and After Construction

There were two locations where the 1998 or 2004 rare plant survey identified sand gilia populations that also were observed at least once in subsequent surveys:

- Staging Area #2; and
- MW-OU1-38-A.

At Staging Area #2, sand gilia was detected in the 1998 survey and in every annual survey conducted between 2004 and 2007. At well MW-OU1-38-A, sand gilia was found in the 1998 survey but not in the 2004 survey. This site was included in the rare plant surveys conducted in 2007, 2011, and 2012. Sand gilia was observed in the 2011 and 2012 surveys. These data indicate that OU-1 remediation activities did not impact sand gilia populations at these sites.

4.2.4 Sand Gilia was Not Detected Before But was Detected After Construction

The rare plant survey results indicated potentially beneficial impacts on sand gilia populations at six sites where this species was not observed before the OU-1 remediation activities beginning in 2004 but was detected in post-construction surveys. The site locations and data are summarized below:

Location	Number of pre-construction surveys (no detections)	Number of post-construction surveys	Number of sand gilia detections
MW-OU1-39-A	2	2	2
EW-OU1-53-A	2	3	2
EW-OU1-54-A	2	5	1
IW-OU1-01-A	2	5	1
MW-OU1-59-A	1	3	1
Staging Area #1	2	3	1

Additional survey results details are provided in Table 3.2.

4.2.5 Well Was Constructed Before the Initial Rare Plant Survey

Sand gilia was observed in one or more rare plant surveys from 1998 through 2011 at 12 locations where wells were constructed before the 1998 survey was performed. Because these wells pre-date the earliest available survey results from 1998, it is not known whether rare plants were present before the wells were constructed. In total, 25 wells were constructed at 21 locations before the 1998 survey. One well was located within the source area and those soils were excavated and replaced with non-native fill. Thus, sand gilia was observed at a detection frequency of 60 percent (12 out of 20 native soil locations) in these wells.

Sand gilia was not detected in any survey at 46 of the 57 locations constructed after 1998—this results in a 20 percent detection frequency. As noted earlier, the 1998 rare plant survey represented exceptionally favorable environmental conditions for Monterey spineflower and sand gilia (UCSC, 2006). Because pre-construction rare plant populations are unknown at these locations, it is not possible to make site-specific comparisons to the post-construction rare plant survey results. However, the fact that sand gilia was found at 60 percent of the well locations in this category versus 20 percent for later wells supports the conclusion that no adverse impact to plant populations occurred as a result of OU-1 remediation activities.

4.3 SUMMARY

The post-construction rare plant surveys were compared with the 1998 and 2004 pre-construction rare plant surveys to assess construction impacts on the FONR rare plant populations. The results of that comparison indicate that the construction activity has not had significant adverse effects on the Monterey spineflower and sand gilia plant populations. Overall, the number of post-construction rare plant populations exceeded the number of populations found in pre-construction surveys. A summary of the supporting observations for this conclusion were described in the preceding paragraphs and are summarized below:

- At locations disturbed by remediation activities after the initial baseline survey in 1998, Monterey spineflower was detected at 32 of the 56 well sites surveyed. Thirteen of the fifty-one well sites did not detect Monterey spineflower in the pre-construction surveys but did find it post-construction. The reverse is true at only eight well sites. Eleven of the fifty-one wells showed Monterey spineflower populations similar to or greater than those in the pre-construction surveys.
- Monterey spineflower was found at 19 of the 21 locations where remediation activities were performed before the 1998 baseline survey.
- Sand gilia was detected at 11 of the 56 well sites where remediation activity began after 1998. Six sites showed sand gilia populations in the post-construction survey but not in any pre-construction survey. The reverse was true at three well sites. Two of the twenty-three well sites showed sand gilia populations similar to or greater than those in the pre-construction surveys.
- Sand gilia was found at 12 of the 21 locations where remediation activities were performed before 1998.

The survey results show there were approximately twice as many cases where rare plant populations were found after remediation activities were performed but not before; this situation indicates that such activities were potentially beneficial to the rare plant species. The 2012 survey results support the conclusion that the OU-1 well construction activity did not significantly impact the OU-1 Monterey spineflower or sand gilia populations.

Manual and mechanical (nonchemical) weed control efforts were initiated throughout the UCSC in 2007 and continued through 2012 as a preventive measure (see Section 1.4 and Appendix B). Visual observations of the extent of the weed populations were made by UCSC field staff in

2012 to determine the effectiveness of the weed control program. UCSC stated that the weed control efforts significantly reduced the survivorship, seed production, and abundance of the target species (see Appendix B). Each year the weed control program removes a large portion of the invasive weed seed source for the subsequent year, thus building on the effectiveness of the program.

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5.0 RECOMMENDATIONS AND FUTURE WORK

After evaluating the data from the 1998 and 2004 through 2012 annual rare plant monitoring (providing 10 years of survey data), HGL concluded that the construction activities associated with the OU-1 groundwater remediation program have not significantly affected rare plant populations within the FONR. The number of rare plant populations that were present after remediation activities (and which were not present in pre-construction surveys) was almost double the number of rare populations that were present before construction activities, but were absent afterward. Three years of annual survey data—at a reference plot unaffected by OU-1 or other anthropogenic activities—showed significant year-to-year variations of rare plant populations. Specifically, there were changes in the physical extent or population of up to plus or minus 85 percent. Rare plant populations in any given year also are highly dependent on environmental factors such as the volume and timing of precipitation and fluctuations in temperature. The remainder of this section presents recommendations for 2013 rare plant monitoring.

The well sites and roadways that border the adjacent grasslands to the north and east of the FONR represent marginal habitat for Monterey spineflower and sand gilia. Although isolated patches of Monterey spineflower are sometimes encountered in this area (sand gilia has not been detected), the predominant pre-construction populations are weeds and invasive grasses. Consequently, the potential impact due to the construction activities is not significant and the rare plant survey program will remain suspended in this region.

As shown in Figure 4.1 and Figure 4.2, construction and well destruction activities were performed in the southern part of OU-1 within the FONR during 2010, 2011, 2012. HGL provided 2 years of monitoring for these sites, in addition to the previous 8 years of monitoring at other OU-1 well sites roadways. Based on the last 10 years of data, HGL proposes suspending further monitoring at the 2010 construction site (pipeline from well modification at IW-OU1-10-A to the OU-1 groundwater treatment plant) and the well location sites for the wells destroyed in 2011.

As noted above, the results from analysis of 10 years of comparative data indicate that the construction activity has not had significant adverse effects on the Monterey spineflower and sand gilia plant populations. Furthermore, HGL believes that the extended 10-year monitoring period has adequately characterized the impacts to Monterey spineflower and sand gilia populations from OU-1 remediation activities. Consequently, HGL will suspend the third year of rare plant monitoring specified in the Habitat Management Plan for the IW-OU1-10-A construction area. HGL also will suspend the second and third years of rare plant monitoring at the well sites where well destruction occurred in 2011.

In summary, the recommended rare plant survey and mitigation measures to be implemented or suspended for 2013 are as follows:

- Continue the weed control program in 2013. The same areas as in 2012 will undergo weed control using the same methods (Figure 1.7). Minimize roadway traffic during groundwater sampling activities to the extent practical.

- Suspend rare plant monitoring at those locations affected by extending the groundwater remediation system to well IW-OU1-10-A.
- Suspend rare plant monitoring at those wells within the FONR habitat that were destroyed in 2011.

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TABLES

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Table 1.1
Wells Within the Fort Ord Natural Reserve

Wells Installed/Sampled Before 2004				Wells Installed for Enchanced Reductive Dechlorination Pilot Study		Wells Installed 2004 through 2006			
Identification	**Year Installed**	**Identification**	**Year Installed**	**Identification**	**Year Installed**	**Identification**	**Year Installed**	**Identification**	**Year Installed**
MW-B-10-A	1976	*MW-OU1-24-A*	1997	*IW-OU1-ERD-01-A*	2002	*IW-OU1-01-A*	2004	PZ-OU1-10-A1	2005
MW-OU1-01-A	1986	MW-OU1-24-AR	2003	*MW-OU1-ERD-01-A*	2002	IW-OU1-02-A	2004	PZ-OU1-46-AD2	2005
MW-OU1-02-A	1986	MW-OU1-25-A	1998	*IW-OU1-ERD-02-A*	2002	PZ-OU1-02-A1	2004		
MW-OU1-03-A	1986	MW-OU1-26-A	1998	*MW-OU1-ERD-02-A*	2002	*IW-OU1-05-A*	2004		
MW-OU1-04-A	1986	MW-OU1-27-A	1998	*IW-OU1-ERD-03-A*	2002	IW-OU1-10-A	2004	EW-OU1-60-A	2006
MW-OU1-05-A	1986	*MW-OU1-28-A*	1998	*MW-OU1-ERD-03-A*	2002	*IW-OU1-13-A*	2004	MW-OU1-61-A	2006
MW-OU1-06-A	1986	MW-OU1-29-A	1998	*IW-OU1-ERD-04-A*	2002	*IW-OU1-24-A*	2004	EW-OU1-62-A	2006
MW-OU1-07-A	1986	*MW-OU1-30-A*	1998	*MW-OU1-ERD-04-A*	2002	*IW-OU1-25-A*	2004	EW-OU1-63-A	2006
MW-OU1-08-A	1986	*MW-OU1-32-A*	1998	*MW-OU1-ERD-05-A*	2002	MW-OU1-46-AD	2004	MW-OU1-64-A1	2006
MW-OU1-09-A	1986	*MW-OU1-33-A*	1998	*MW-OU1-ERD-06-A*	2002	EW-OU1-47-A	2004	MW-OU1-64-A2	2006
MW-OU1-10-A	1987	*MW-OU1-34-A*	1998	*MW-OU1-ERD-07-A*	2002	*EW-OU1-48-A* *	2004	MW-OU1-65-A	2006
MW-OU1-11-SVA	1986	*PZ-OU1-35-A*	1998	MW-OU1-ERD-08-A	2002	EW-OU1-49-A	2004	EW-OU1-66-A	2006
MW-OU1-12-A	1988	*MW-OU1-36-A*	1999			PZ-OU1-49-A1	2004	MW-OU1-67-A	2006
PZ-OU1-13-A	1988	*MW-OU1-37-A*	1999			MW-OU1-50-A	2004	MW-OU1-68-A	2006
PZ-OU1-14-A	1988	*MW-OU1-38-A*	1999			MW-OU1-51-A	2004	EW-OU1-71-A	2006
PZ-OU1-15-A	1988	*MW-OU1-39-A*	1999			EW-OU1-52-A	2004	EW-OU1-72-A	2006
PZ-OU1-16-A	1988	MW-OU1-40-A	1999			EW-OU1-53-A	2004	IW-OU1-73-A	2006
EW-OU1-17-A	1987	MW-OU1-41-A	2001			*EW-OU1-54-A*	2004	IW-OU1-74-A	2006
EW-OU1-18-A	1987	MW-OU1-43-A	2001			*EW-OU1-55-A*	2004	MW-OU1-82-A	2006
MW-OU1-19-A	1993	*MW-OU1-44-A*	2001			MW-OU1-56-A	2004	MW-OU1-83-A	2006
MW-OU1-20-A	1993	MW-OU1-45-A	2001			MW-OU1-57-A	2004	MW-OU1-84-A	2006
MW-BW-10-A	1997	MW-OU1-46-A	2001			MW-OU1-58-A	2004	MW-OU1-85-A	2006
MW-OU1-21-A	1997	*MW-OU1-01-180*	2000			MW-OU1-59-A	2004	MW-OU1-86-A	2006
MW-OU1-22-A	1997	*MW-OU1-02-180*	2000					MW-OU1-87-A	2006
MW-OU1-23-A	1997	*MW-OU1-03-180*	2000					MW-OU1-88-A	2006

Notes:

Well name in Italics indicates that well has been abandoned.

ERD - enhanced reduction dechlorination

EW - extraction well

IW - injection well

MW - monitoring well

OU1 - Operable Unit 1

PZ - piezometer

SVA - Salinas Valley Acquiclude

Table 1.2
Soil Borings and Wells Destroyed 2004 - 2011
within the Fort Ord Natural Reserve

Identification	Year Boring Abandoned or Well Destroyed	Identification	Year Boring Abandoned or Well Destroyed	Identification	Year Boring Abandoned or Well Destroyed
SB-OU1-2004-I	2004	MW-BW-10-A	2011	MW-OU1-32-A	2011
SB-OU1-2004-J	2004	MW-OU1-01-180	2011	MW-OU1-33-A	2011
SB-OU1-2004-K	2004	MW-OU1-01-A	2011	MW-OU1-34-A	2011
SB-OU1-2004-L	2004	MW-OU1-02-180	2011	MW-OU1-36-A	2011
SB-OU1-2004-M	2004	MW-OU1-02-A	2011	MW-OU1-37-A	2011
SB-OU1-46-AD1	2005	MW-OU1-03-180	2011	MW-OU1-38-A	2011
SB-OU1-60-A	2005	MW-OU1-03-A	2011	MW-OU1-39-A	2011
EW-OU1-48-A	2006	MW-OU1-04-A	2011	MW-OU1-42-A	2011
EW-OU1-17-A	2011	MW-OU1-05-A	2011	MW-OU1-44-A	2011
EW-OU1-18-A	2011	MW-OU1-06-A	2011	MW-OU1-ERD-01-A	2011
EW-OU1-54-A	2011	MW-OU1-07-A	2011	MW-OU1-ERD-02-A	2011
EW-OU1-55-A	2011	MW-OU1-08-A	2011	MW-OU1-ERD-03-A	2011
IW-OU1-01-A	2011	MW-OU1-09-A	2011	MW-OU1-ERD-04-A	2011
IW-OU1-05-A	2011	MW-OU1-10-A	2011	MW-OU1-ERD-05-A	2011
IW-OU1-13-A	2011	MW-OU1-11-SVA	2011	MW-OU1-ERD-06-A	2011
IW-OU1-24-A	2011	MW-OU1-19-A	2011	MW-OU1-ERD-07-A	2011
IW-OU1-25-A	2011	MW-OU1-20-A	2011	PZ-OU1-13-A	2011
IW-OU1-ERD-01-A	2011	MW-OU1-21-A	2011	PZ-OU1-14-A	2011
IW-OU1-ERD-02-A	2011	MW-OU1-28-A	2011	PZ-OU1-15-A	2011
IW-OU1-ERD-03-A	2011	MW-OU1-30-A	2011	PZ-OU1-16-A	2011
IW-OU1-ERD-04-A	2011	MW-OU1-31-A	2011	PZ-OU1-35-A	2011

Notes:

OU-1- operable unit 1
EW - extraction well
SB - soil boring
MW- monitoring well
PZ- piezometer
IW- injection well

Table 1.3
Summary of 2012 Groundwater Long Term Monitoring Program

Well Identification	Groundwater Sampling Events*	
	Mar-12	Sep-12
MW-OU1-46-AD	X	
EW-OU1-60-A	--	
EW-OU1-62-A	--	
EW-OU1-63-A	--	
EW-OU1-66-A	X	
EW-OU1-71-A	X	
MW-OU1-85-A	X	
MW-OU1-87-A	X	
IW-OU1-10-A	X	
IW-OU1-02-A	water level only	
PZ-OU1-10-A1	X	
MW-OU1-22-A	water level only	
MW-OU1-23-A	water level only	
MW-OU1-24-AR	water level only	
MW-OU1-25-A	water level only	
MW-OU1-26-A	water level only	
MW-OU1-27-A	water level only	
MW-OU1-29-A	water level only	
MW-OU1-40-A	water level only	
MW-OU1-41-A	water level only	
MW-OU1-43-A	water level only	
MW-OU1-45-A	water level only	
MW-OU1-46-A	water level only	
EW-OU1-47-A	water level only	
EW-OU1-48-A	no longer sampled	
EW-OU1-49-A	water level only	
PZ-OU1-49-A1	X	
MW-OU1-50-A	water level only	
MW-OU1-51-A	water level only	
EW-OU1-52-A	water level only	
EW-OU1-53-A	water level only	
MW-OU1-56-A	water level only	
MW-OU1-57-A	water level only	
MW-OU1-58-A	water level only	
MW-OU1-59-A	water level only	
MW-OU1-61-A	X	
MW-OU1-64-A1	water level only	
MW-OU1-64-A2	water level only	
MW-OU1-65-A	water level only	
MW-OU1-67-A	water level only	
MW-OU1-68-A	water level only	

Table 1.3
Summary of 2012 Groundwater Long Term Monitoring Program

Well Identification	Groundwater Sampling Events*	
	Mar-12	Sep-12
MW-OU1-69-A2	X	
MW-OU1-70-A	X	
EW-OU1-72-A	X	
IW-OU1-73-A	water level only	
IW-OU1-74-A	water level only	
MW-OU1-82-A (MW-G)	water level only	
MW-OU1-83-A (MW-F)	water level only	
MW-OU1-84-A (MW-E)	water level only	
MW-OU1-86-A (MW-C)	water level only	
MW-OU1-88-A (MW-A)	water level only	
MW-BW-10-A	water level only	
MW-OU1-ERD-08-A	water level only	

Notes:

* includes sampling of extraction wells

Italicized well name indicates the well is not located within the Fort Ord Natural Reserve.

Identification in parantheses indicates temporary well name used in early planning documents.

X - sample collected

-- no sample collected

ERD - enhanced reductive dechlorination

EW - extraction well

IW - injection well

SVA - Salinas Valley Aquiclude

OU1 - Operable Unit 1

MW - monitoring well

PZ - piezometer

Table 3.1
Rare Plant Survey Results for Reference Plot - 2010 through 2012

Sand Gilia

Year Surveyed	Number of Point Populations	Number of Individuals at Point Populations	Number of Polygon Populations	Number of Individuals at Polygon Populations	Total Number of Individuals
2010	7	18	7	1068	1086
2011	12	40	4	278	318
2012	12	21	4	49	70

Monterey Spineflower

Year Surveyed	Number of Populations with < 5 Individual Plants	Total Number of Individual Plants	Number of Populations with > 5 Individual Plants	Plant Cover Density Summary for Areas With > 5 Individual Plants				
				Sparse	Medium-Low	Medium	Medium-High	Very High
2010	0	0	2	1	1	0	0	0
2011	1	4	1	0	1	0	0	0
2012	1	4	2	2	0	0	0	0

Monterey Spineflower Plant Cover Density Categories Based on Percentage of Plant Cover of Total Ground Area

Very Sparse (less than 3 percent),

Sparse (3 to 25 percent),

Medium Low (26 to 50 percent),

Medium (51 to 76 percent),

Medium High (76 to 97 percent),

Very High (greater than 97 percent).

Table 3.2
Rare Plant Survey Results Relative to OU-1 Well Locations

Well Identification	1998	2004	2005	2006	2007	2008	2009	2010	2011	2012	Remarks Regarding Results for Given Year								
											2004	2005	2006	2007	2008	2009	2010	2011	2012
Wells Installed Before 1998																			
EW-OU1-17-A*	SG; MS	N	--	N	N	--	--	--	MS	MS								MS#91[ML]; MS#92[S] nearby	MS#90[S]; MS#74[S]
EW-OU1-18-A*	SG; MS	SG; MS	--	N	SG	--	--	--	SG	MS, SG	SG#07[100]; MS#07[1000]			SG#22[75]				SG#35[4]; SG#36[2]	MS#93[S]; SG#48[13]; SG#6[4], SG#52[10]
PZ-OU1-13-A*	MS	MS	--	MS	N	--	--	--	MS	MS	MS#216[100]		MS#46[S]					MS#91[ML]	MS#90[S]; MW#74[S]
PZ-OU1-14-A*	SG; MS	N	--	N	MS	--	--	--	MS	MS				MS#49[VS]				MS#91[ML]; MS#92[S] nearby	MS#90[S]; MW#74[S]
PZ-OU1-15-A*	SG; MS	SG; MS	--	N	N	--	--	--	MS, SG	MS, SG	SG#07[100]; MS#07[1000]							MS#109[S]; SG#[35]; SG#[38]; SG#[37]	MS#93[S]; SG#48[13]; SG#6[4], SG#52[10]
PZ-OU1-16-A*	SG; MS	SG; MS	--	N	SG	--	--	--	SG	MS, SG	SG#07[100]; MS#07[1000]			SG#22[75]				SG#37[9]; SG#38[3]; SG#39[2]	MS#93[S]; SG#48[13]; SG#6[4], SG#52[10]
MW-BW-10-A*	N	--	N	N	N	--	--	--	MS	MS, SG	MS#166, 167 & 215 nearby							MS#[78]; MS# [67], MS#[66]	MS#82[S]; SG#9[1]; SG#10[2], SG#11[1]
MW-OU1-01-A*	SG; MS	--	--	--	--	--	--	--	MS	MS, SG								MS#68[1]; MS#79[S]; MS#80[S]; MS#81[S]	MS#42[1]; SG#53[17]
MW-OU1-02-A*	SG; MS	--	--	--	--	--	--	--	SG, MS	SG								SG#11[2]; SG#7[3]; SG#8[3]; SG#9[1]; SG#10[4]; MS#111[ML]; SG#12, 54, 55, 56, 57, & 58 nearby	SG#55[10]; SG#15[1]; SG#16[4]; SG#17[1]; SG#14[2]; SG#54[10]; SG#13[2]; SG#56[11]
MW-OU1-03-A*	MS	SG; MS	N	N	SG; MS	--	--	--	SG, MS	MS, SG	SG#07[100]; MS#07[1000]			SG#21[100]; MS#44[S]				MS#99[S]; SG#34[5]	MS#93[S]; SG#48[13]
MW-OU1-04-A*	N	N	--	--	--	--	--	--	MS	N								MS#70[2]; MS#71[5]	
MW-OU1-05-A*	MS	SG	N	N	N	--	--	--	MS	MS	SG#261[25]							MS#69[1]; MS#88[S]	MS#75[S]
MW-OU1-06-A*	SG	--	--	--	--	--	--	--	MS	MS								MS#82[S]; MS#83[M], MS#84 & 85 across street	MS#102[ML]
MW-OU1-07-A*	N	N	N	--	N	--	--	--	N	N									
MW-OU1-08-A*	SG	MS	--	--	--	--	--	--	MS	MS	MS#20[100]							MS#103[ML]	MS#40[1]; MS#80[S]
MW-OU1-09-A*	MS	MS	MS	--	--	--	--	--	MS, SG	MS, SG	MS#20[100]	MS#82[S]						MS#94[ML]; SG#1-6 along access road	MS#73[S]; MS#100[ML]; MW#45[1]; SG#25[1]; SG#26[3]
MW-OU1-10-A*	MS	N	N	--	--	--	--	--	N	N									
MW-OU1-11-SVA*	MS	MS	--	--	SG, MS	--	--	--	SG, MS	MS, SG	MS#220[1000]; extends far beyond well			SG#20; MS#42				SG#27[3]; SG#28[1]; SG#29[2]; SG#30[2]; SG#40[1]; SG#61[18]; MS#100[S]	MS#98[S]; MS#71[S]; SG#8[2]; SG#7[1]; SG#52[10], SG#6[4]
Wells Installed Before 1998 (Continued)																			
MW-OU1-12-A*	N	--	--	--	--	--	--	--	--	--	Well destroyed in 2002								
MW-OU1-19-A*	SG; MS	MS	--	SG; MS	--	--	--	--	SG, MS	MS, SG	MS#57[1000]; extends far beyond well		SG#33[375]; MS#45[S]					SG#53[697]; MS#89[S]	MS#76[S]; MS#77[S], MS#95[S]; SG#64[562]
MW-OU1-20-A*	N	N	MS	--	--	--	--	--	MS	N		MS#126[VS]						MS#95[S]	
MW-OU1-21-A*	N	--	N	--	--	--	--	--	MS	MS								MS#102[S]	MS#88[S]
MW-OU1-22-A	N	MS	N	N	N	--	--	--	--	--	MS#90[1000]; extends far beyond well								
MW-OU1-23-A	MS	N	--	--	--	--	--	--	--	N									
MW-OU1-24-A	MS	--	--	--	--	--	--	--	--	--	Well destroyed in 2003; see replacement well MW-24-AR								
MW-OU1-24-AR	MS	N	N	MS	N	--	--	--	--	--			MS#59[VS]						
Wells Installed from 1998 - 2001																			
MW-OU1-25-A	MS	N	--	--	--	--	--	--	--	N									
MW-OU1-26-A	N	N	--	N	N	--	--	--	--	--									
MW-OU1-30-A*	N	N	--	MS	MS	--	--	--	--	--			MS#79[S]	MS#26[S]					
MW-OU1-32-A*	N	N	--	--	--	--	--	--	MS	MS								MS#76[1]; MS#101[S]	MS#41[3]; MS#97[S]
MW-OU1-33-A*	N	N	--	--	--	--	--	--	MS	MS								MS#76[1]; MS#101[S]	MS#41[3]; MS#97[S]
MW-OU1-36-A*	N	--	--	--	--	--	--	--	N	N									
MW-OU1-37-A*	N	N	--	--	--	--	--	--	N	N									
MW-OU1-38-A*	SG	N	--	--	N	--	--	--	MS, SG	MS, SG								MS#105[S]; MS#106, 107, & 108, SG#31, 32, & 33 nearby	MS#96[S]; MS#92[S]; SG#2[1]; SG#47[10], SG#3[1]
MW-OU1-39-A*	MS	MS	--	--	--	--	--	--	SG, MS	MS, SG	MS#220[1000]; extends far beyond well							SG#17[5]; SG#18[2]; SG#15[1]; SG#16[4]; MS#98[MD]	MS#98[S]; SG#49[18]

Table 3.2
Rare Plant Survey Results Relative to OU-1 Well Locations

Well Identification	1998	2004	2005	2006	2007	2008	2009	2010	2011	2012	Remarks Regarding Results for Given Year								
											2004	2005	2006	2007	2008	2009	2010	2011	2012
Wells Installed from 1998 - 2001 (Continued)																			
MW-OU1-39-A west access road	MS	SG, MS	--	--	--	--	--	--	SG, MS	MS, SG	MS#220 [1000]; SG#003 [50]; MS#002 [100]							MS#98[MH]; SG#59[66]; SG#19[1], SG#20[4]; SG#21[2]; SG#22[1]; SG#23[1]; SG#60[41]	MS#98[S]; SG#50[53]; SG#4[4]; SG#51[13]; SG#5[1]
MW-OU1-39-A east access road	MS	MS	--	--	--	--	--	--	MS, SG	MS	MS#220[1000]							MS#98[MH]; SG#24[2]; SG#25[4]; SG#26[1]	MS#98[S]
MW-OU1-40-A	MS	N	N	--	--	--	--	--	--	N									
MW-OU1-44-A*	SG; MS	--	--	--	--	--	--	--	MS	MS								MS#[87]	MS#101[ML]
MW-OU1-45-A	N	--	N	N	N	--	--	--	--	--									
MW-OU1-46-A	MS	N	N	N	N	MS	MS	MS	--	--					MS#34[VS]	MS#27[M]			
MW-OU1-01-180*	N	--	--	--	--	--	--	--	N	N									
MW-OU1-02-180*	N	--	--	--	--	--	--	--	N	N									
MW-OU1-03-180*	N	N	N	N	--	--	--	--	N	N									
Wells Installed in 2004 After the Rare Plant Survey																			
MW-OU1-46-AD	MS	N	N	N	N	MS	MS	--	--	--					MS#34[VS]	MS#27[M]			
EW-OU1-47-A	N	N	N	N	N	--	N	--	--	--	Located in grassland east of FONR.								
EW-OU1-48-A	N	N	N	N	N	--	--	--	--	--	Located in grassland east of FONR.								
EW-OU1-49-A	MS	N	N	N	N	--	--	--	--	--									
EW-OU1-52-A	N	N	N	N	N	--	--	--	--	--									
EW-OU1-53-A	MS	N	N	MS, SG	MS,SG	--	--	--	--	--			MS#92[S]; SG#21-#25 & 30	SG#24[16]; MS#52[VS]; MS#53 [VS]					
EW-OU1-54-A*	N	N	MS	N	N	--	--	--	SG, MS	N		MS#126[VS]						MS#72[4]; MS#96[S]; MS#97[S]; SG#13 & #14 nearby	
EW-OU1-55-A*	N	N	N	N	N	--	--	--	MS	MS								MS#90[S]	MS#78[S]
IW-OU1-01-A*	MS	N	N	MS, SG	MS	--	--	--	MS	MS			MS#46[S]; and SG#2-6 nearby	MS#50[S]				MS#91[ML]	MS#90[S]
IW-OU1-02-A	N	N	--	N	N	--	--	--	--	--									
IW-OU1-05-A*	N	N	--	MS	MS	--	--	--	MS	MS			MS#49[VS]	MS#46[VS]				MS#86[S]	MS#91[S]
IW-OU1-10-A	N	N	--	N	N	--	--	--	--	N									
IW-OU1-13-A*	--	--	--	--	--	--	--	--	--	--	Located in grassland east of FONR.								
IW-OU1-24-A*	N	N	--	N	MS	--	--	--	MS	MS				MS#35[VS]				MS#104[S]	MS#81[S]
IW-OU1-25-A*	N	MS, SG	N	N	N	--	--	--	MS	MS	MS#135[5];and SG#30 [2]							MS#73[4]; MS#74[4]; MS#75[4]	MS#86[S]
MW-OU1-51-A	N	N	N	N	N	N	N	--	--	--									
PZ-OU1-49-A1	MS	N	N	N	N	--	--	--	--	--									
Wells Installed in 2004 in Area Not Surveyed																			
MW-OU1-50-A	MS	--	MS	N	MS	MS	MS	--	--	--		MS#21[MD]		MS#61[ML]	MS#49[ML]; and MS#50[S]	MW#36[S]; MW#4[2]; MW#5[2]			
MW-OU1-56-A	MS	--	N	MS	N	--	--	--	--	--		MS#146[1] nearby	MS#76[VS] nearby						
MW-OU1-57-A	MS	--	N	N	N	--	--	--	--	--									
MW-OU1-58-A	N	--	N	N	N	--	--	--	--	--									
MW-OU1-59-A	N	--	MS	SG	N	--	--	--	--	--		MS#153[2]	SG#26[13]						
Staging Areas Used in 2004																			
Area # 1	MS	N	N	SG; MS	MS	--	--	--	--	--			SG#7[1]; MS#50[S]; and MS#52[S]	MS#9[3]; MS#39[VS]; MS#40[S]					
Area # 2	SG; MS	SG	SG; MS	SG; MS	SG; MS	--	--	--	--	--	SG#011[10]	SG#045[1]; MS#047[S]	SG#35[110]; SG#37[80]; and MS#54[S]	SG#18[36]; MS#8[1]; MS#36[S]; MS#37[S]					
Area # 3	SG[1]	N	N	MS	MS	--	--	--	--	--			MS#39[1]; MS#56[VS]; and MS#57[VS]	MS#41[S]					

Table 3.2
Rare Plant Survey Results Relative to OU-1 Well Locations

Well Identification	1998	2004	2005	2006	2007	2008	2009	2010	2011	2012	Remarks Regarding Results for Given Year								
											2004	2005	2006	2007	2008	2009	2010	2011	2012
Wells Installed in 2005 After the Rare Plant Survey																			
PZ-OU1-10-A1	N	N	--	N	N	--	--	--	--	--									
PZ-OU1-46-AD2	MS	N	--	N	N	MS	N	--	--	--					MS#4[1]				
HCPP Wells Installed Along Northwest Boundary Road in 2006 Before the Rare Plant Survey																			
EW-OU1-60-A	MS	--	N	N	N	N	--	--	--	--									
EW-OU1-62-A	N	--	N	N	N	--	--	--	--	--									
EW-OU1-63-A	N	--	N	N	N	--	--	--	--	--									
EW-OU1-66-A	MS	--	N	N	N	--	--	--	--	--									
MW-OU1-61-A	MS	--	N	N	N	N	--	--	--	--									
MW-OU1-64-A1	N	--	N	N	N	--	--	--	--	--									
MW-OU1-64-A2	N	--	N	N	N	--	--	--	--	--									
MW-OU1-65-A	MS	--	N	N	N	--	--	--	--	--									
MW-OU1-67-A	N	--	N	N	N	--	--	--	--	--									
MW-OU1-68-A	N	--	N	N	N	--	--	--	--	--									
Wells Installed in 2006 After the Rare Plant Survey																			
EW-OU1-71-A	N	N	--	N	N	MS	N	--	--	--					MS#42[S]				
EW-OU1-72-A	N	N	N	N	N	N	N	--	--	--									
IW-OU1-73-A	N	--	N	N	N	N	N	--	--	--									
IW-OU1-74-A	N	--	N	N	MS	MS	MS	--	--	--				MS#60[VS]	MS#39[S]	MS#41[S]; MS#33[ML]			
MW-OU1-82-A	N	--	N	N	N	MS	MS	--	--	--					MS#51[ML]	MS#10[2]			
MW-OU1-83-A	N	N	N	N	N	MS	MS	--	--	--					MS#26[1]; and MS#46[S] adjacent	MW#23[2]; MW#24[2]; MW#25[1]			
MW-OU1-84-A	N	--	N	N	N	MS	MS	--	--	--				MS#58 across the road	MS#37[ML]; and MS#36[ML] across road	MS#28[M]; MS#15[3]			
MW-OU1-85-A	N	N	N	N	N	N	N	--	--	--									
MW-OU1-86-A	N	N	--	N	N	N	N	--	--	--									
MW-OU1-87-A	N	N	N	N	N	N	N	--	--	--									
MW-OU1-88-A	N	N	--	N	N	N	N	--	--	--									

Notes:

No new wells have been installed since 2006.
*This well has been abandoned.
-- not surveyed
EW - extraction well
FONR - Fort Ord Natural Reserve
HCCP - Hydraulic Control Pilot Project
ID - identification
IW - injection well
MD - medium high
ML - medium low
MS - Monterey spineflower
MS#49[VS] - population ID # [density category or number of plants]
SG[1] - Given map scale, it is possible that the observed sand gilia population was just outside the northwest boundary of the staging area.
#49 - indicates population ID number assigned in corresponding annual rare plant survey; [13] indicates number of plants.
SG - Sand gilia
SG#26[13] - population ID # [number of plants]
S - sparse
VS - very sparse
MW - monitoring well
N - area was surveyed; but no rare plants were detected.
OU1 - operable unit 1
PZ - piezometer
RP/HS - rare plant/habitat survey; population ID# & segment identification refers to Figures A3.1 through A3.3 in Appendix A.

Table 3.3
Fort Ord Precipitation Data - 1998-2012

Year	October - March Rainfall (inches)
1998	22.36
2004	10.32
2005	21.73
2006	14.18
2007	7.88
2008	9.71
2009	11.89
2010	16.85
2011	17.29
2012	11.3
Average	**14.35**

Notes:
Precipitation information obtained from
http://met.nps.edu/~ldm/renard_wx/

FIGURES

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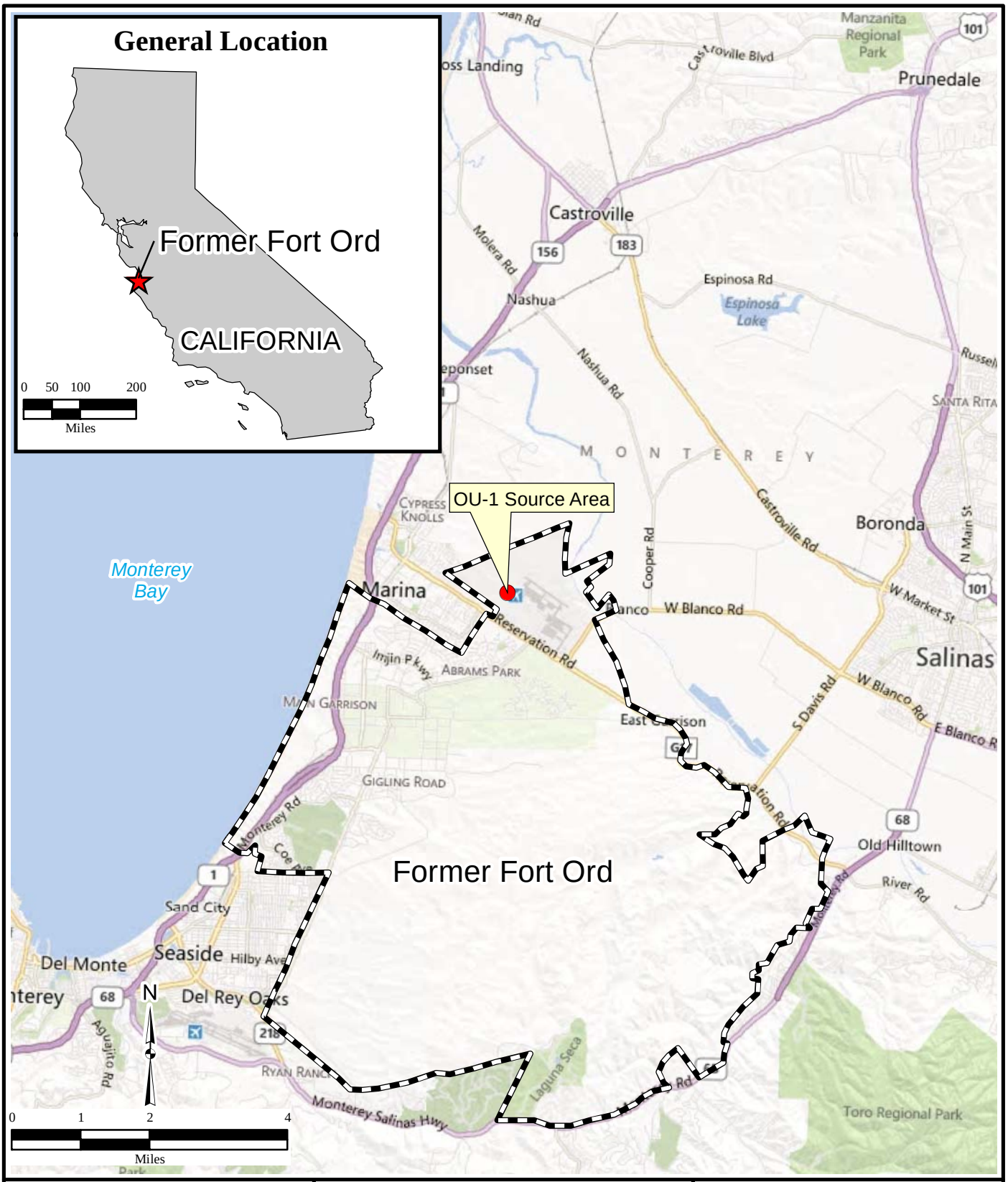

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1/9/2013 CNL; QC: 1/9/2013 PD
Source: HGL
ESRI Online Bing Maps Road Map

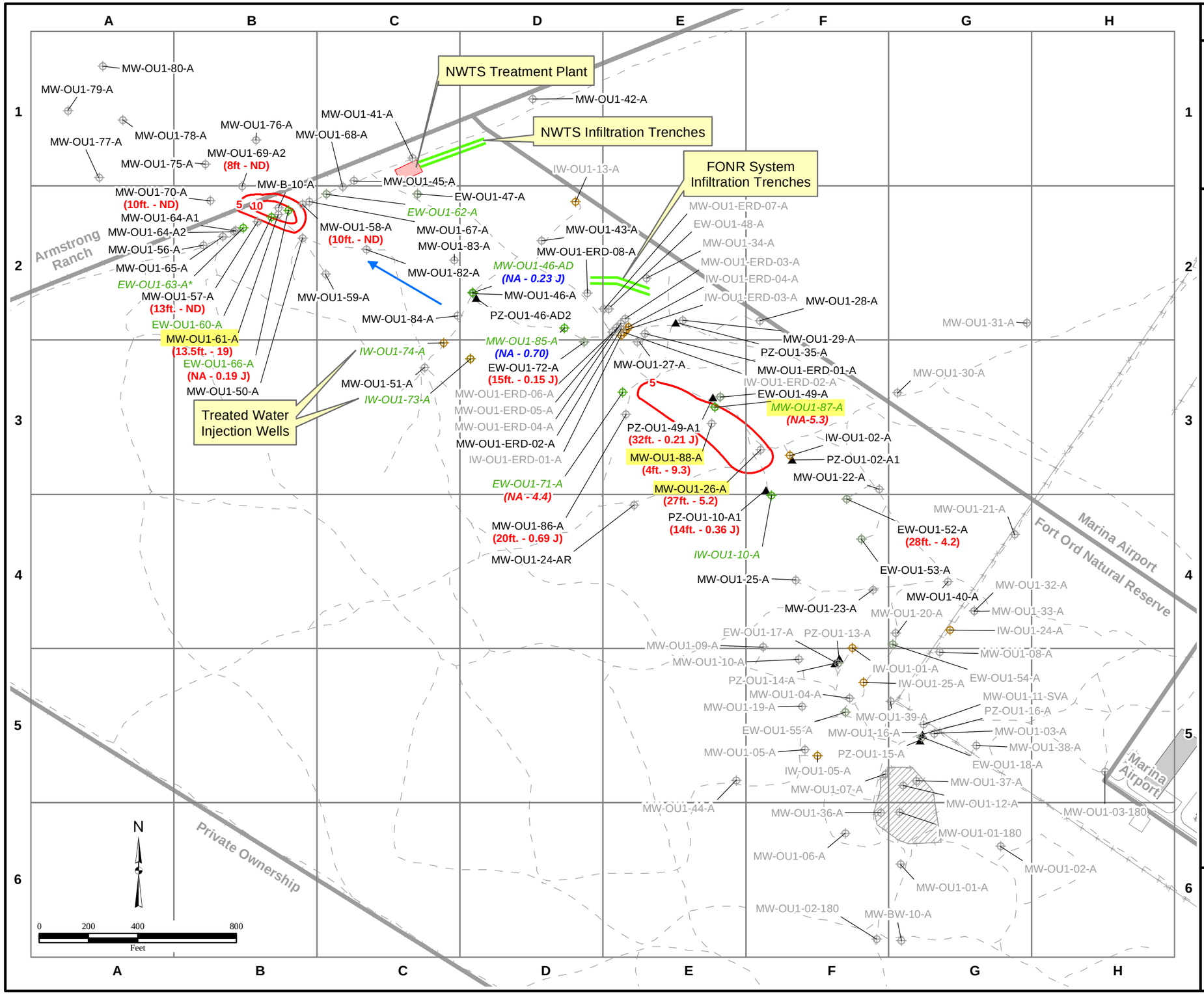
Legend

OU-1 Source Area

Former Fort Ord

Figure 1.1
Former Fort Ord

Figure 1.2
OU-1 FONR
TCE Concentration in Groundwater
September 2012



Legend

- Monitoring Well
- Extraction Well
- Injection Well
- Piezometer
- Groundwater Flow Direction
- (27ft. - 7.1) TCE Result from March 2012 Data
- MW-0U1-21-A Well Destroyed
- MW-0U1-45-A Location with September 2012 TCE Concentration at or above ACL (5 µg/L)
- MW-0U1-45-A Well ID
- (122ft - 12) September 2012 TCE Result (µg/L)
- Sample Elevation (feet above mean sea level)
- 5 TCE Concentration Contour Based on September 2012 Data
- Trail/Unimproved Road
- Fence
- Treated Water Infiltration Trench
- Property Boundary
- Treatment Plant
- Building
- Former Fire Drill Area

Notes:
Wells shown with an asterisk were not used to develop contour boundaries.
Wells for which no data are posted were not sampled.
Trichloroethene (TCE) concentrations are reported in micrograms per liter (ug/L).
Green font indicates extraction or injection well.
Italicized font shows pumping suspended in March 2012.

*=Disconnected extraction well. No longer operable.
ACL=Aquifer Cleanup Level
FONR=Fort Ord Natural Reserve
J=Estimated value
NA=Depth is not applicable–sample is from pumping well
ND=nondetect
NWTS=Northwest Treatment System
OU-1=Operable Unit 1

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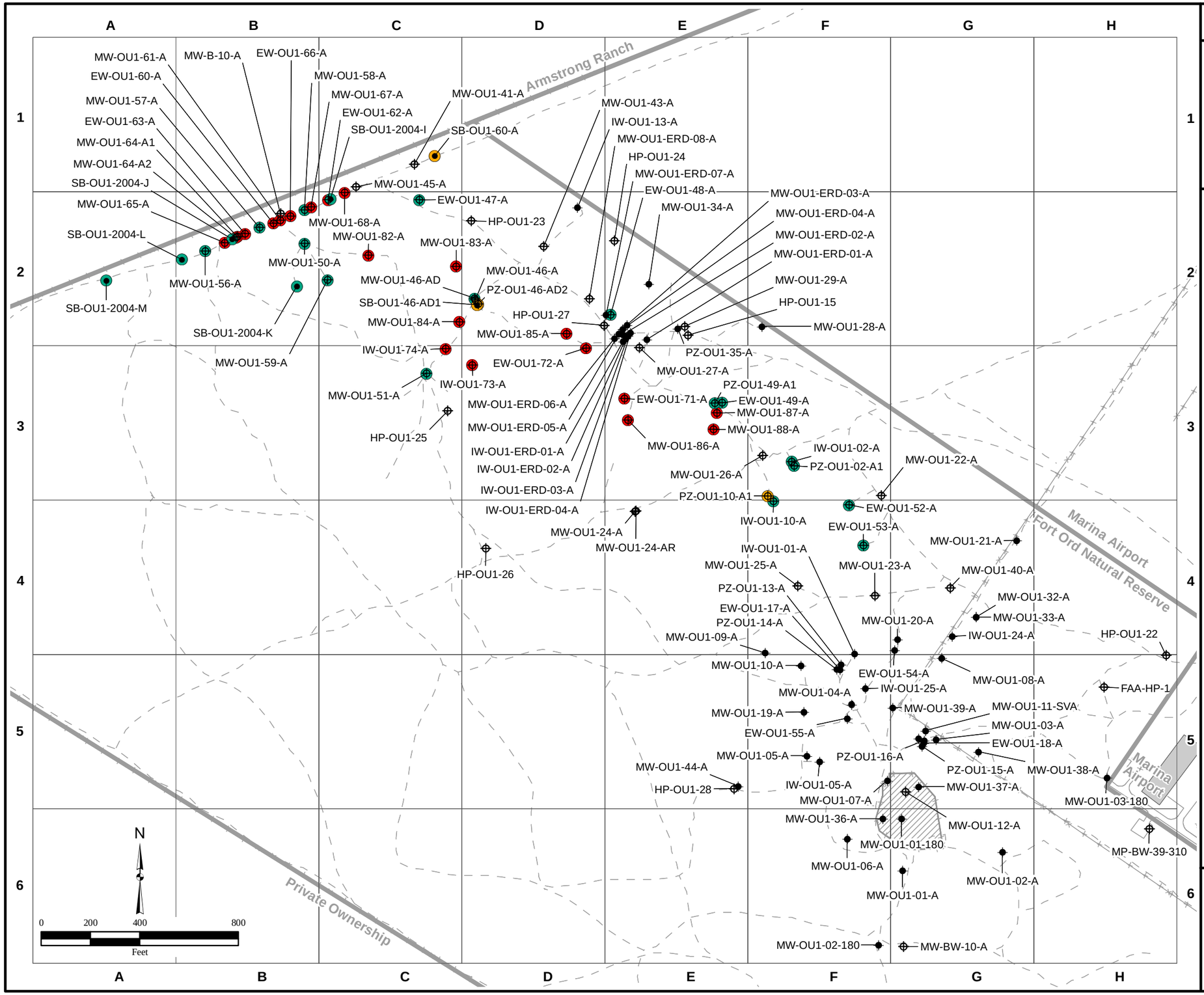
(1-02)TCE_GW_Sept_12.mxd
1/9/2013 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 1.3
OU-1 Soil Borings, Wells, and Piezometers Constructed Within the FONR



Legend

- Well/Piezometer Drilled Before 2004
- Abandoned Soil Boring
- Well Destroyed September 2011
- 2004 Well/Piezometer
- 2004 Soil Boring (abandoned)
- 2005 Well/Piezometer
- 2005 Soil Boring (abandoned)
- 2006 Well/Piezometer
- MW-OU1-21-A — Well or Boring ID
- Trail/Unimproved Road
- Fence
- Property Boundary
- Former Fire Drill Area
- Building

Notes:
FONR=Fort Ord Natural Reserve
OU-1=Operable Unit 1

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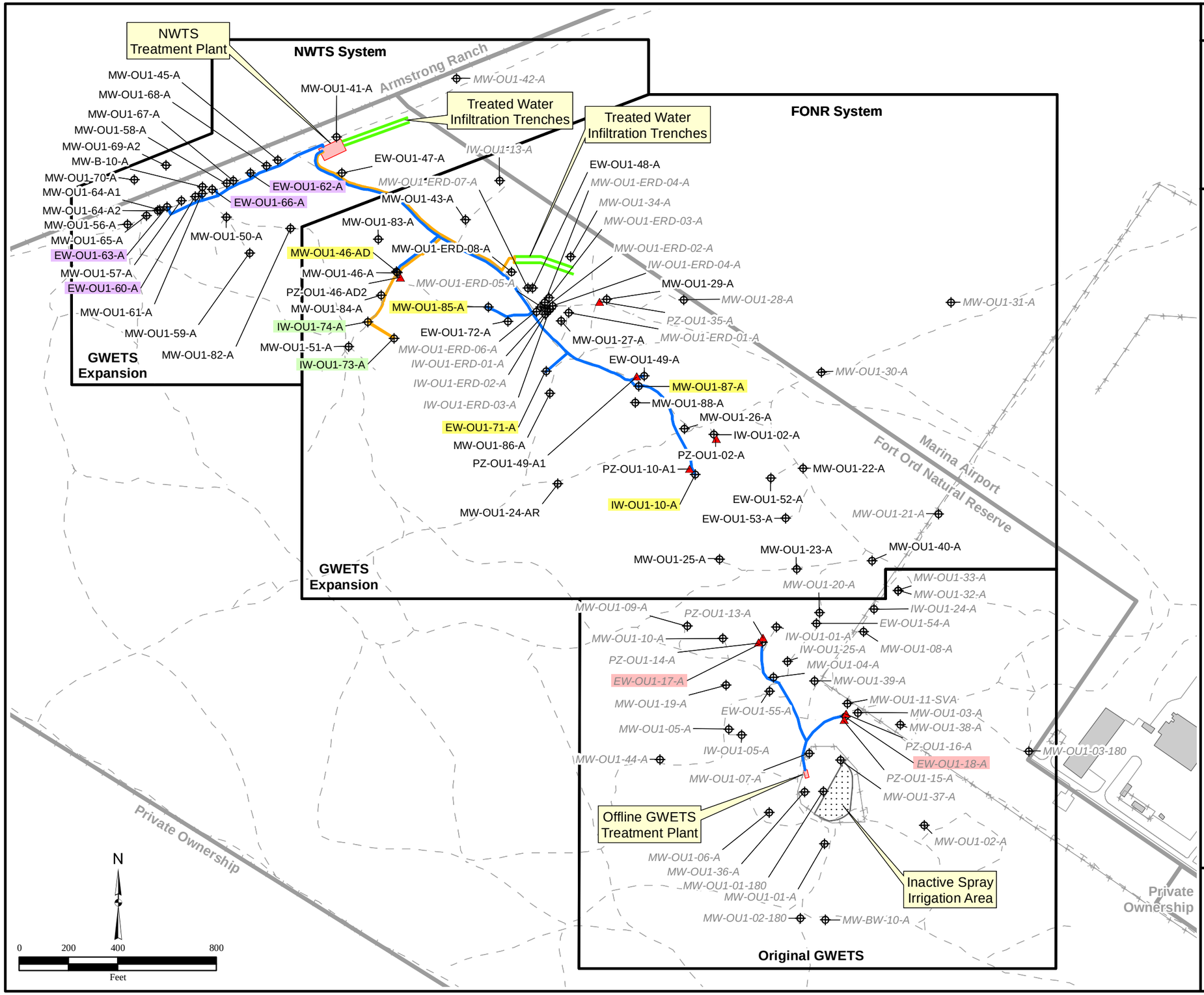
1/9/2013 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 1.4
Fort Ord Natural Reserve (FONR)
OU-1 Remediation System Areas



Legend

- Well
- Piezometer
- EW-OU1-18-A — Original GWETS Extraction Well
- IW-OU1-74-A — FONR Injection Well
- MW-OU1-46-AD — FONR Extraction Well
- EW-OU1-63-A — NWTS Extraction Well
- MW-OU1-31-A — Well Destroyed September 2011
- Trail/Unimproved Road
- Fence
- Extraction Pipeline
- Treated Water Pipeline
- Treated Water Infiltration Trench
- Property Boundary
- Treatment Plant
- Inactive Spray Irrigation Area
- Building

Notes:
The treated water and extraction water pipelines are located in separate trenches within or near the existing roadway. The separation shown in this figure is exaggerated for clarity.

FONR=Fort Ord Natural Reserve
GWETS=Groundwater Extraction and Treatment System
NWTS=Northwest Treatment System
OU-1=Operable Unit 1

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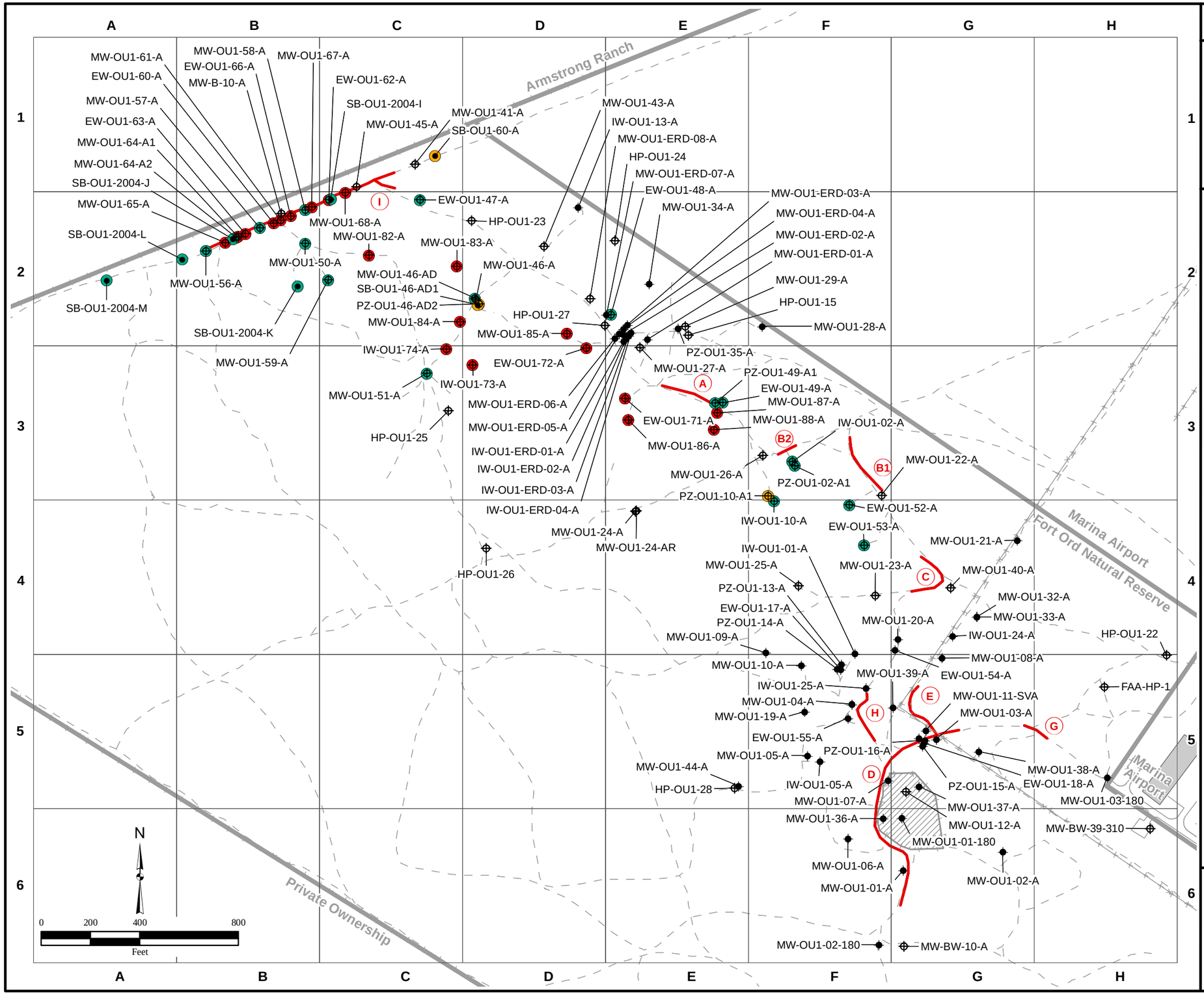
(1-04)GW_Remediation _Sys.mxd
1/9/2013 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 1.5
Locations of OU-1
Roadway Erosion Repair Areas



Legend

- Well/Piezometer Drilled Before 2004
- Abandoned Soil Boring
- Well Destroyed September 2011
- 2004 Well/Piezometer
- 2004 Soil Boring (abandoned)
- 2005 Well/Piezometer
- 2005 Soil Boring (abandoned)
- 2006 Well/Piezometer
- MW-OU1-21-A Well or Boring ID
- Trail/Unimproved Road
- Fence
- Potential Erosion Repair Area
- A Roadway Segment Identifier
- Property Boundary
- Former Fire Drill Area
- Building

Note:
OU-1=Operable Unit 1

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(1-05)Roadway_Repairs.mxd
1/9/2013 CNL
Source: HGL

HydroGeoLogic, Inc

	Segment A	Segment D	Segment E
Before Roadway Erosion Repairs:			
After Roadway Erosion Repairs:			

Note:
OU-1=Operable Unit 1

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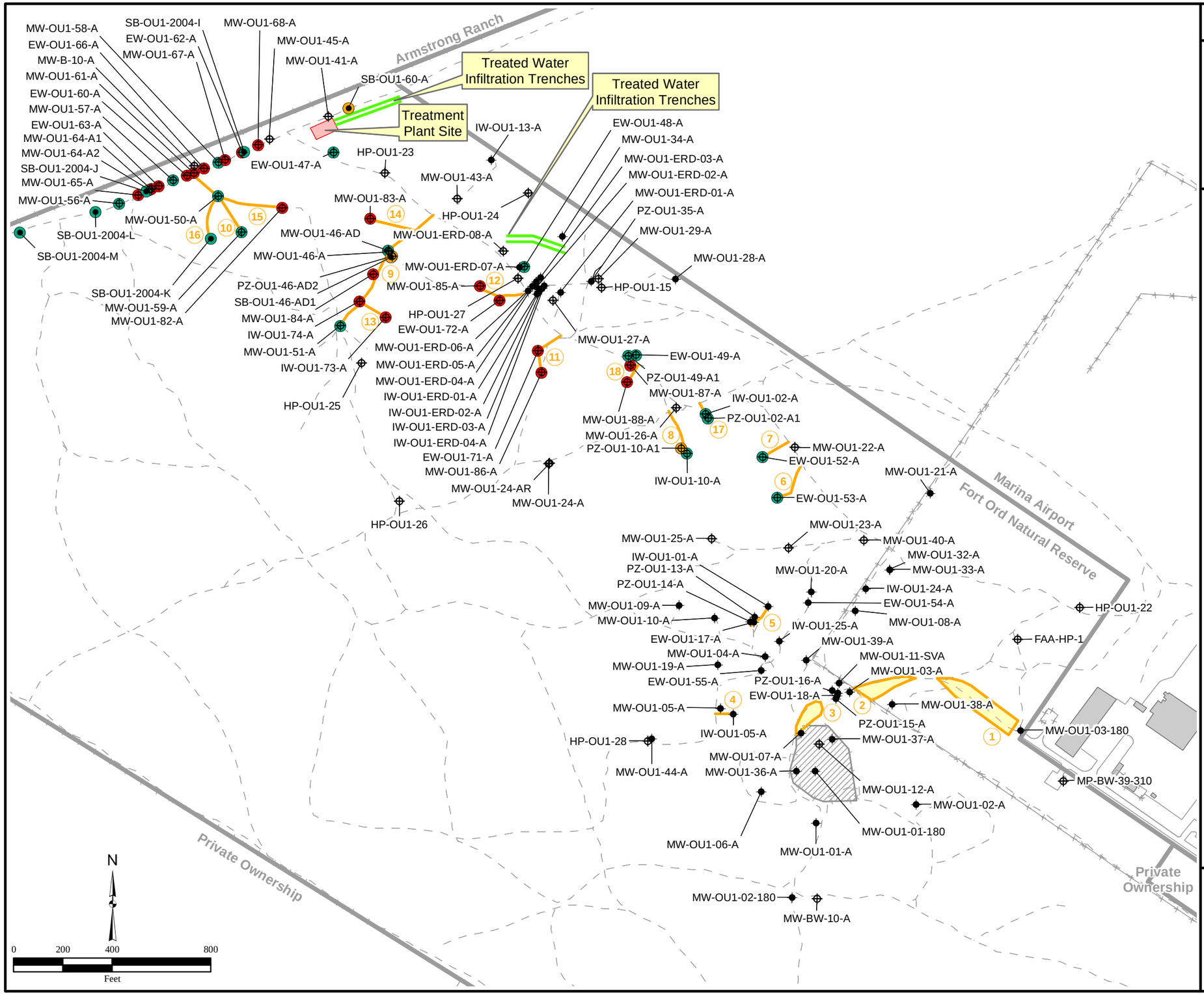
1/9/2013 CNL
Source: HGL

Figure 1.6
OU-1 Roadway Photographs
Before and After Erosion Repairs

Figure 1.7
Year 2012
OU-1 Weed Control Segment Locations



Legend

- Well/Piezometer Drilled Before 2004
- Abandoned Soil Boring
- Well Destroyed September 2011
- 2004 Well/Piezometer
- 2004 Soil Boring (abandoned)
- 2005 Well/Piezometer
- 2005 Soil Boring (abandoned)
- 2006 Well/Piezometer
- MW-OU1-21-A — Well or Boring ID
- Weed Control Segment
- (1) Active Weed Control Segment Identification Number
- Trail/Unimproved Road
- Fence
- Treated Water Infiltration Trench
- Property Boundary
- Southern Staging Area in 2004
- Treatment Plant
- Building
- Former Fire Drill Area

Note:
OU-1=Operable Unit 1

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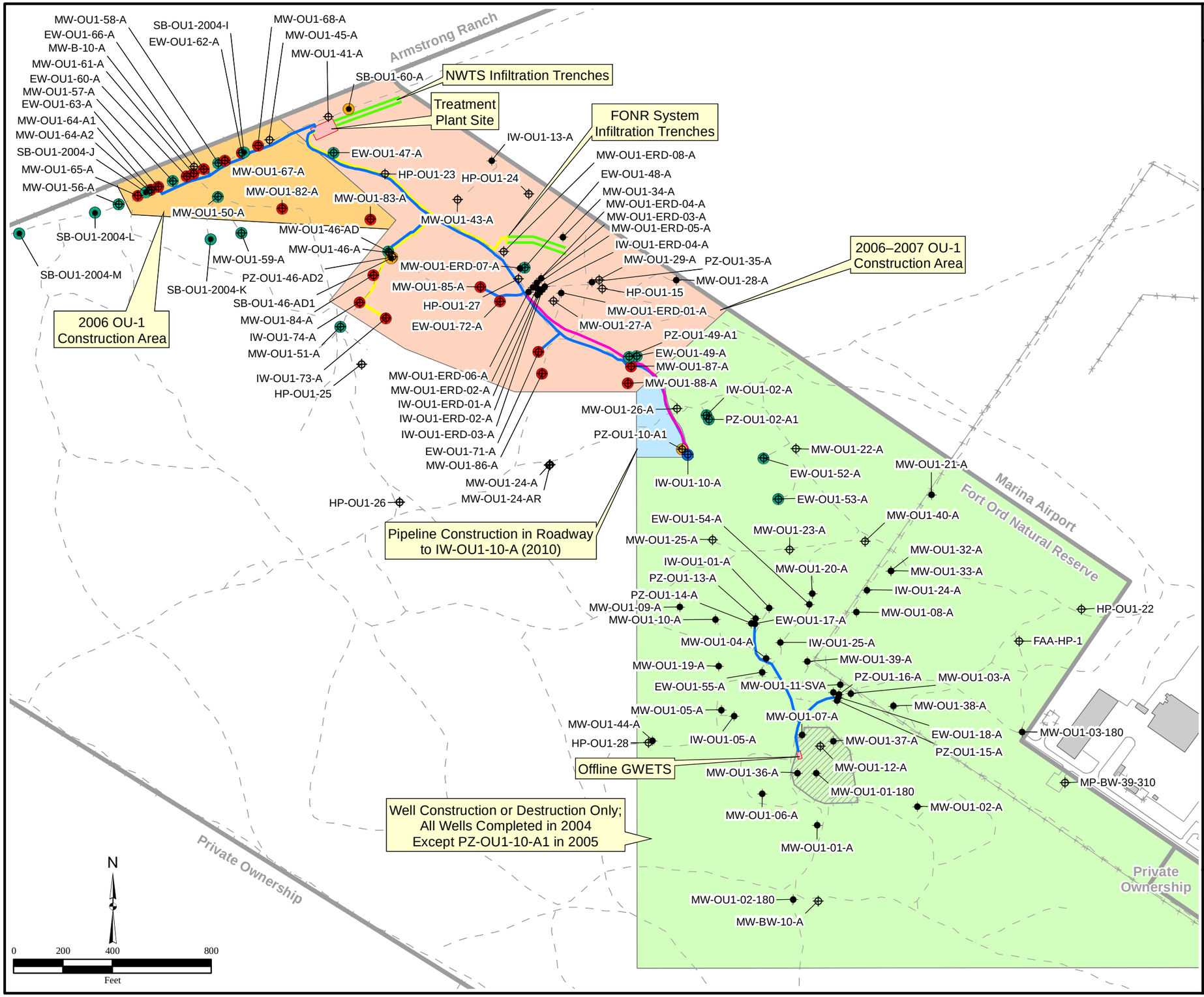
1/9/2013 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 4.1
OU-1 Construction Activities
2004–2012



Legend

- Well/Piezometer Drilled Before 2004
- Abandoned Soil Boring
- Well Destroyed September 2011
- 2004 Well/Piezometer
- 2004 Soil Boring (abandoned)
- 2005 Well/Piezometer
- 2005 Soil Boring (abandoned)
- 2006 Well/Piezometer
- Existing Well Modified in 2010
- MW-OU1-21-A — Well or Boring ID
- IW-OU1-10-A Pipeline Route
- Extraction Pipeline
- Infiltration Trench
- Treated Water Pipeline
- Trail/Unimproved Road
- Fence
- Property Boundary
- Treatment Plant
- Building
- Former Fire Drill Area

Notes:
The treated water and extraction water pipelines are located in separate trenches within or near the existing roadway. The separation shown in this figure is exaggerated for clarity.

FONR=Fort Ord Natural Reserve
GWETS=Groundwater Extraction and Treatment System
NWTS=Northwest Treatment System
OU-1=Operable Unit 1

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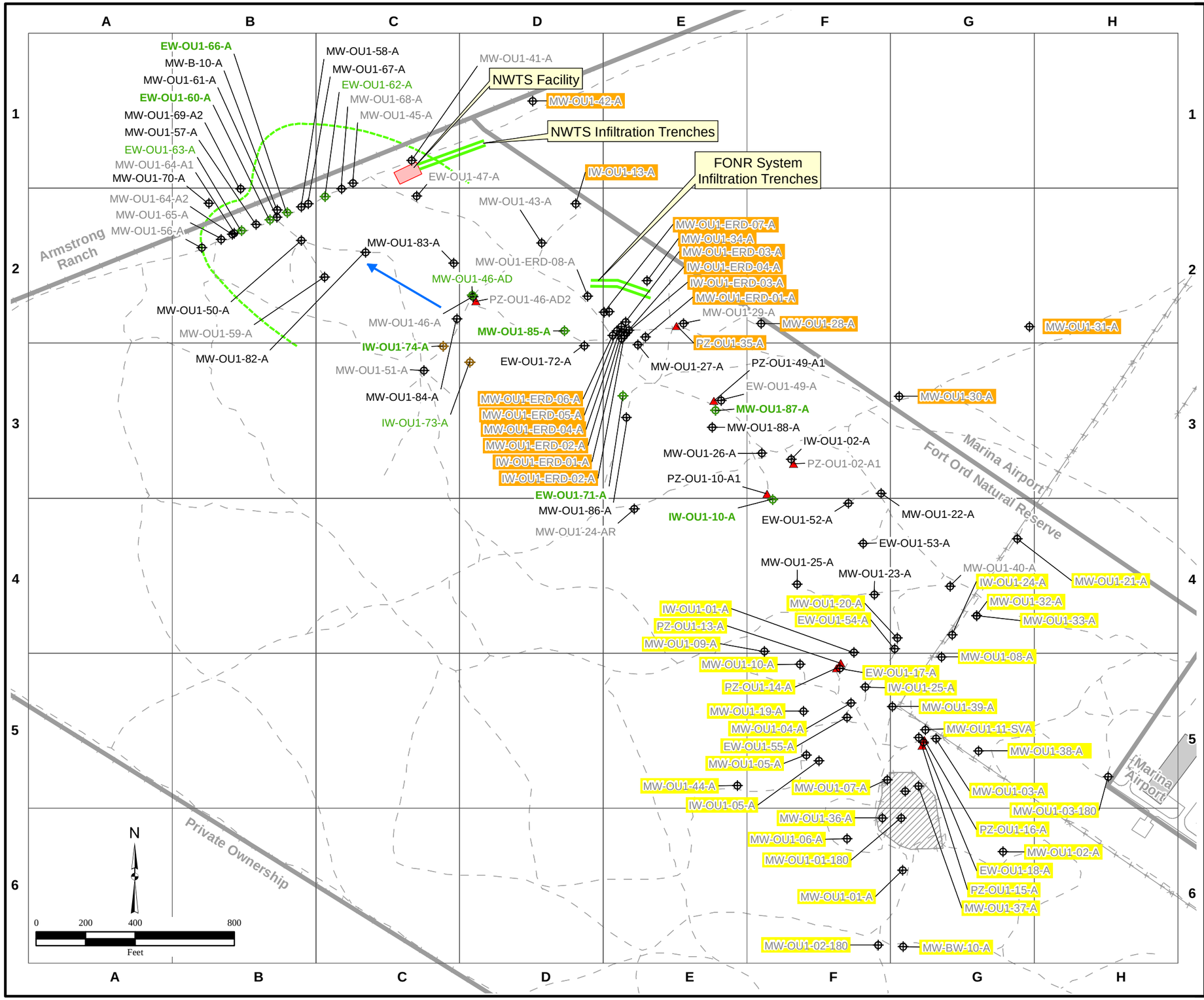
1/10/2013 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 4.2
Former Fort Ord OU-1
Wells Destroyed in 2011



Legend

- Monitoring Well
- Extraction Well
- Injection Well
- Piezometer
- MW-OU1-88-A — Well ID
- MW-OU1-87-A — Active Well
- EW-OU1-62-A — Inactive Well
- MW-OU1-30-A — Well Destroyed in Grassland or Northwest Boundary Road
- MW-OU1-02-A — Well Destroyed Within FONR Habitat Area
- Trail/Unimproved Road
- Fence
- Treated Water Infiltration Trench
- Estimated Northwest Treatment System Capture Zone
- Groundwater Flow Direction
- Property Boundary
- Treatment Plant
- Building
- Former Fire Drill Area

Notes:
FONR=Fort Ord Natural Reserve
NWTS=Northwest Treatment System
OU-1=Operable Unit 1

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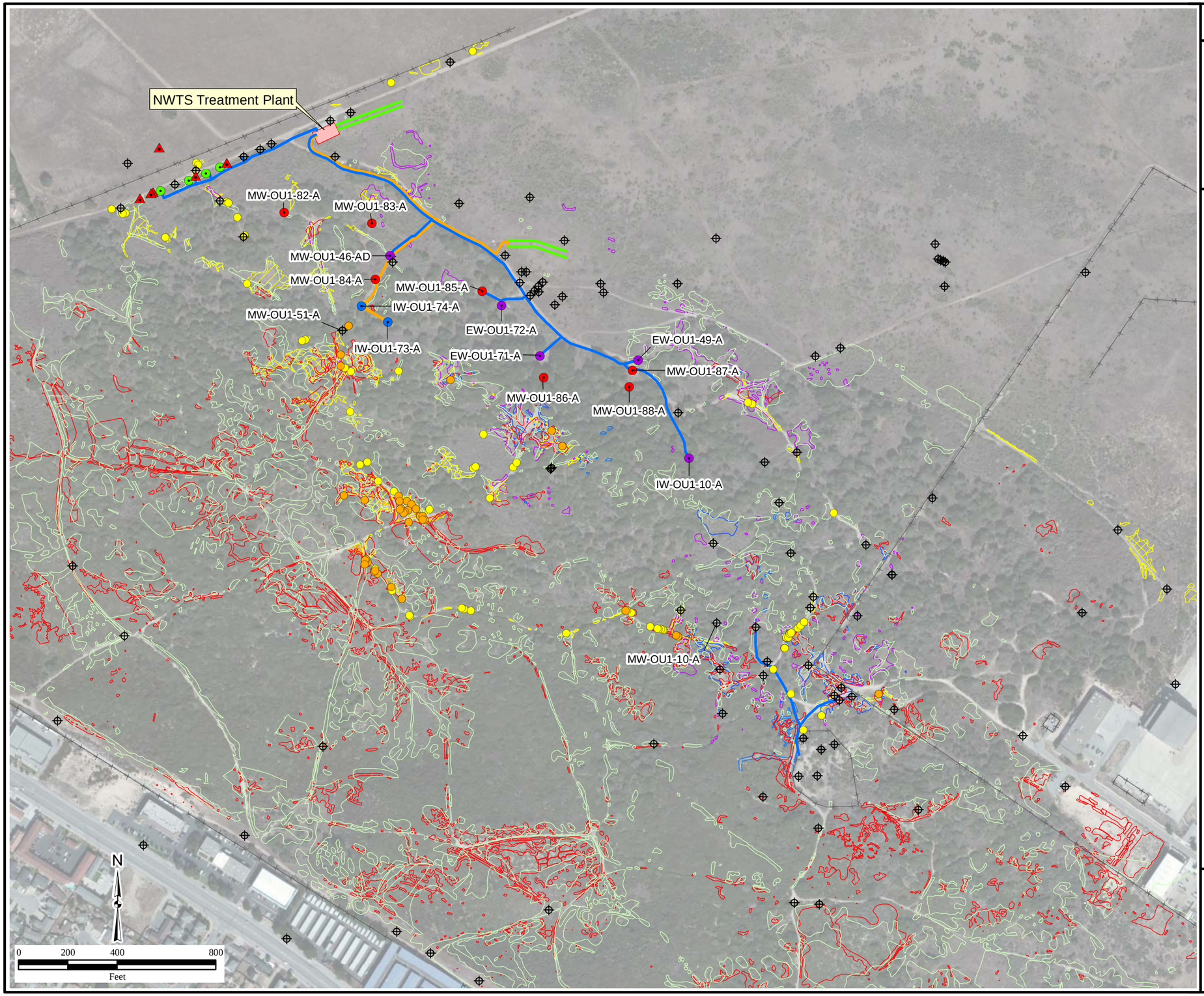
1/10/2013 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 4.3
Summary
of Rare Plant Survey Results
1998–2005



Legend

- Monitoring Well
- Northwest Treatment System Extraction Well
- Northwest Treatment System Performance Monitoring Well
- FONR OU-1 Monitoring Well
- FONR OU-1 Extraction Well
- FONR OU-1 Injection Well
- Extraction Pipeline Route
- Infiltration Trench
- Treated Water Pipeline Route
- Fence

1998 Rare Plant Survey (UC Santa Cruz):

- Sand Gilia
- Monterey Spineflower

2004 Rare Plant Survey (CH2MHill):

- Sand Gilia
- Monterey Spineflower

2005 Rare Plant Survey (CH2MHill):

- Sand Gilia
- Monterey Spineflower
- Sand Gilia
- Monterey Spineflower–High Density
- Monterey Spineflower–Medium Density
- Monterey Spineflower–Sparse Density
- Monterey Spineflower–Very Sparse Density

Notes:
FONR=Fort Ord Natural Reserve
NWTS=Northwest Treatment System
OU-1=Operable Unit 1

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(4-03)98-05_Plant_Survey.mxd
1/9/2013 CNL
Source: HGL, CH2MHill, UC Santa Cruz
ArcGIS Online Bing Maps Aerial

HGL HydroGeoLogic, Inc

2012 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS OPERABLE UNIT 1 FORMER FORT ORD, CALIFORNIA

Appendix A
Results of 2012 Monterey Spineflower and Sand Gilia Surveys

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Results of the 2012 Monterey Spineflower and Sand Gilia Surveys

OU-1, Fort Ord Natural Reserve, California

Prepared for HydroGeoLogic Inc.

Prepared By Denise Duffy & Associates, Inc.

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Acronym List

CDFG	California Department of Fish and Game
CNDDB	California Natural Diversity Database
DD&A	Denise Duffy & Associates, Inc.
FDA	Fire Drill Area
FONR	Fort Ord Natural Reserve
ft^2	square feet
GIS	geographic information system
GPS	global positioning system
GWETS	groundwater extraction and treatment system
HGL	HydroGeoLogic, Inc.
HMP	Habitat Management Plan
OU	operable unit
TCE	trichloroethene
UCNRS	University of California Natural Reserve System
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

A1.0 Introduction

HydroGeoLogic, Inc. (HGL) is executing a groundwater remediation project at Operable Unit (OU)-1 at the former Fort Ord U.S. Army Base located in Monterey County, California (Figure A1.1). This work was awarded to HGL in December 2003 by the U.S. Army Corps of Engineers (USACE)-Sacramento District under Contract Number DACA45-03-D-0029. Denise Duffy & Associates (DD&A) performed the work described herein under subcontract to HGL.

Fort Ord was established in 1917 as a military training base for infantry troops. In January 1991, the Secretary of Defense announced the downsizing/closure of the base. In August 1994, portions of the property were transferred to the University of California and the Fort Ord Natural Reserve (FONR) was established in June 1996. The former Fort Ord is located near Monterey Bay approximately 80 miles south of San Francisco. The base consists of approximately 28,000 acres near the cities of Seaside, Sand City, Monterey, Del Rey Oaks, and Marina. Monterey Bay marks the western boundary, Toro Regional Park borders the base to the southeast, and land use to the east is primarily agricultural.

Activities conducted at the former Fort Ord Fritzsche Army Airfield Fire Drill Area (FDA) (the source area for OU1 contaminants) between 1962 and 1985 resulted in the release of contaminants to soils and groundwater. Although 10 volatile organic compounds (VOCs) were identified as contaminants of concern in groundwater underlying OU1, trichloroethene (TCE) is the contaminant that was detected at the highest concentrations and across the greatest extent of the affected aquifer. A groundwater extraction and treatment system (GWETS) was constructed in 1988 to remediate TCE and other groundwater contaminants.

A key factor that affected the design and implementation of the groundwater cleanup is the fact that the groundwater plume lies beneath a part of the University of California Natural Reserve System (UCNRS) designated as the FONR. The FONR area potentially impacted by the construction of OU1 remediation facilities is approximately 130 acres. Rare plant surveys are required by the Habitat Management Plan (U.S. Army, 1997) (HMP) in areas that are disturbed during construction activities associated with remediation efforts. Project activities undertaken to achieve the OU1 cleanup must protect and maintain the special-status species found within the FONR, specifically two federally listed plant species: Monterey spineflower (*Chorizanthe pungens* var. *pungens*) and sand gilia (*Gilia tenuiflora* ssp. *arenaria*). As part of the current remediation project, rare plant surveys were conducted in 2012 to meet the overall objective of protecting these two special status plant species in areas affected by construction activities. This report details the surveys completed in April 2012.

A1.1 Survey Objectives

The objectives of the 2012 rare plant surveys were to:

1. Map Monterey spineflower and sand gilia at a DD&A reference site southeast of the FONR property;
2. Map Monterey spineflower and sand gilia at well locations within the sensitive habitat portions of the FONR where existing wells were dismantled and destroyed in late 2011; and
3. Map Monterey spineflower and sand gilia in areas impacted by construction activities performed in 2010 to convert existing monitoring well IW-OU1-10-A into an extraction well and connect it to the treatment plant.

The DD&A reference site location is shown on Figure A1.2. The well locations that were dismantled and destroyed in 2011 within the FONR sensitive habitat area and then surveyed for Monterey spineflower and sand gilia in 2012 are shown on Figure A1.3. The area impacted by the IW-OU1-10-A construction activities in 2010 and then surveyed in 2012 is shown on Figure A1.4.

A1.2 Site Location and Description

The dominant habitats in the area surrounding the well locations include coast live oak woodland, maritime chaparral, coastal scrub, disturbed/developed land, and annual grassland. Several special-status plant and wildlife species occur within the FONR, including sand gilia and Monterey spineflower. The northern and eastern boundary of OU1 is adjacent to a large expanse of non-native grassland. Transmission of non-native grass species into OU1 is accelerated by the prevailing southern winds, which blow seeds into the OU1 area (Fusari, 2004). Non-native grasses and weedy forbs are already present throughout much of the OU1 area. The spread of non-native, invasive species into newly disturbed areas might result in population declines of Monterey spineflower and, especially, sand gilia, which is less tolerant of competing plant cover than Monterey spineflower.

Coast live oak woodland is the dominant habitat in the reference area. Grassland and coast live oak woodland is adjacent to the reference site on the northwestern boundary. All other sides of the reference area are bordered by paved roadways (Reservation Road, MBEST Drive, and University Drive). Non-native grasses and weedy forbs are present throughout much of the reference area.

A1.1.1 Sand Gilia

Sand gilia is a small annual in the phlox family (*Polemoniaceae*). Plants range in height from two to six inches with a small, basal rosette of leaves. The lower branches of the stem are generally densely glandular. Plants typically bloom from April through June and have funnel-shaped flowers with narrow, purple to pinkish petal lobes and a purple throat. This species occurs in open sandy soils in dune scrub, coastal sage scrub, and maritime chaparral habitats. Sand gilia is endemic to Monterey Bay and the peninsular dune complexes. A search of the California Natural Diversity Database (CNDDB) revealed that there are 28 occurrences within Monterey County, including the occurrences at Fort Ord (CDFG, 2012). It is likely that some of these occurrences are no longer present and the exact number of extant (still in existence) occurrences are unknown.

A1.1.2 Monterey Spineflower

Monterey spineflower is a small, prostrate annual in the buckwheat family (*Polygonaceae*) that blooms from April to June. The white to rose floral tube of Monterey spineflower distinguishes it from the more common, but closely related diffuse spineflower (*Chorizanthe diffusa*), which has a lemon-yellow floral tube. This species typically occurs on open sandy or gravelly soils in coastal dune, coastal scrub, and maritime chaparral habitats. There are 24 records of Monterey spineflower within Monterey County in the CNDDB (CDFG, 2012); however, it is not known how many of these are extant.

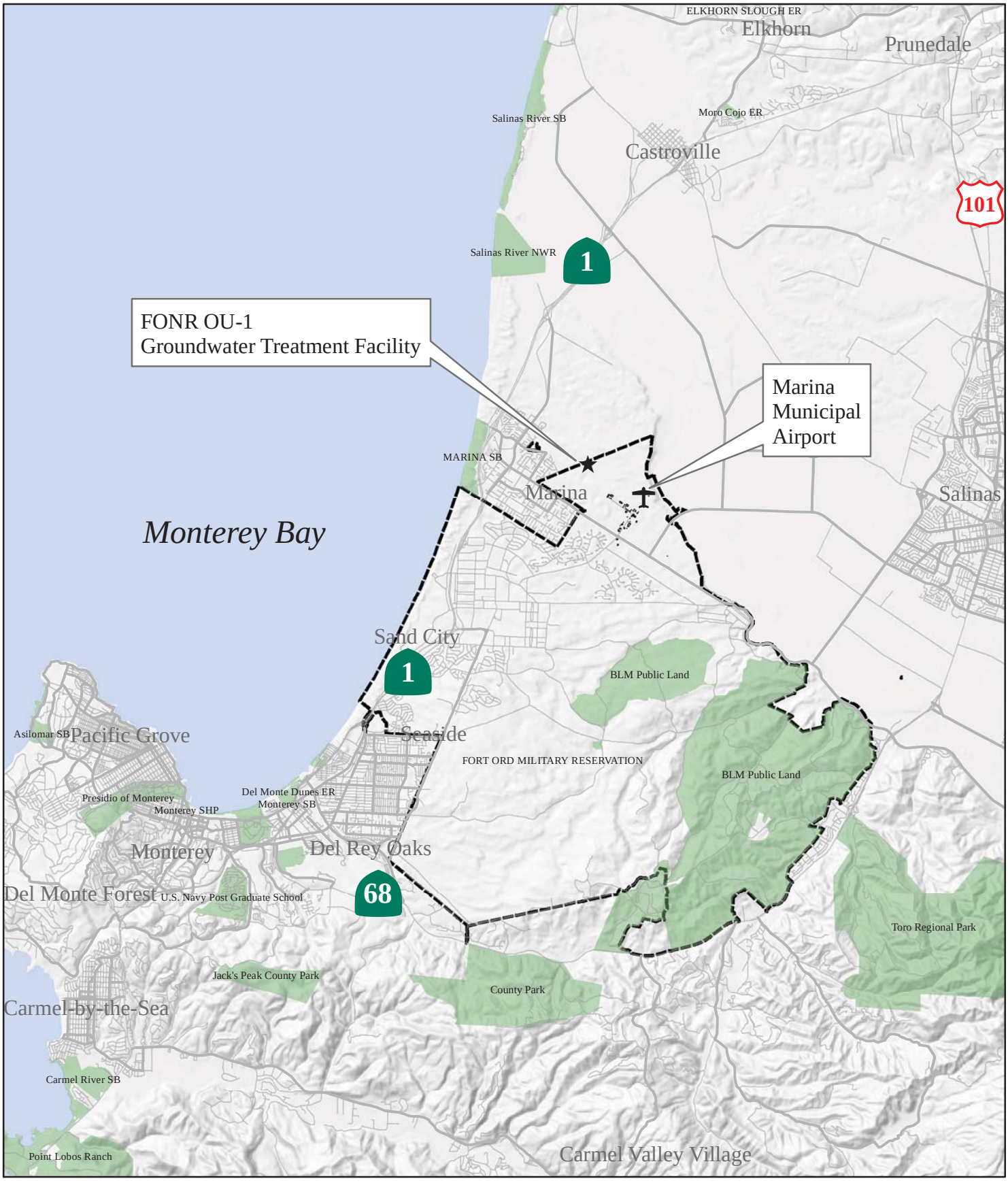
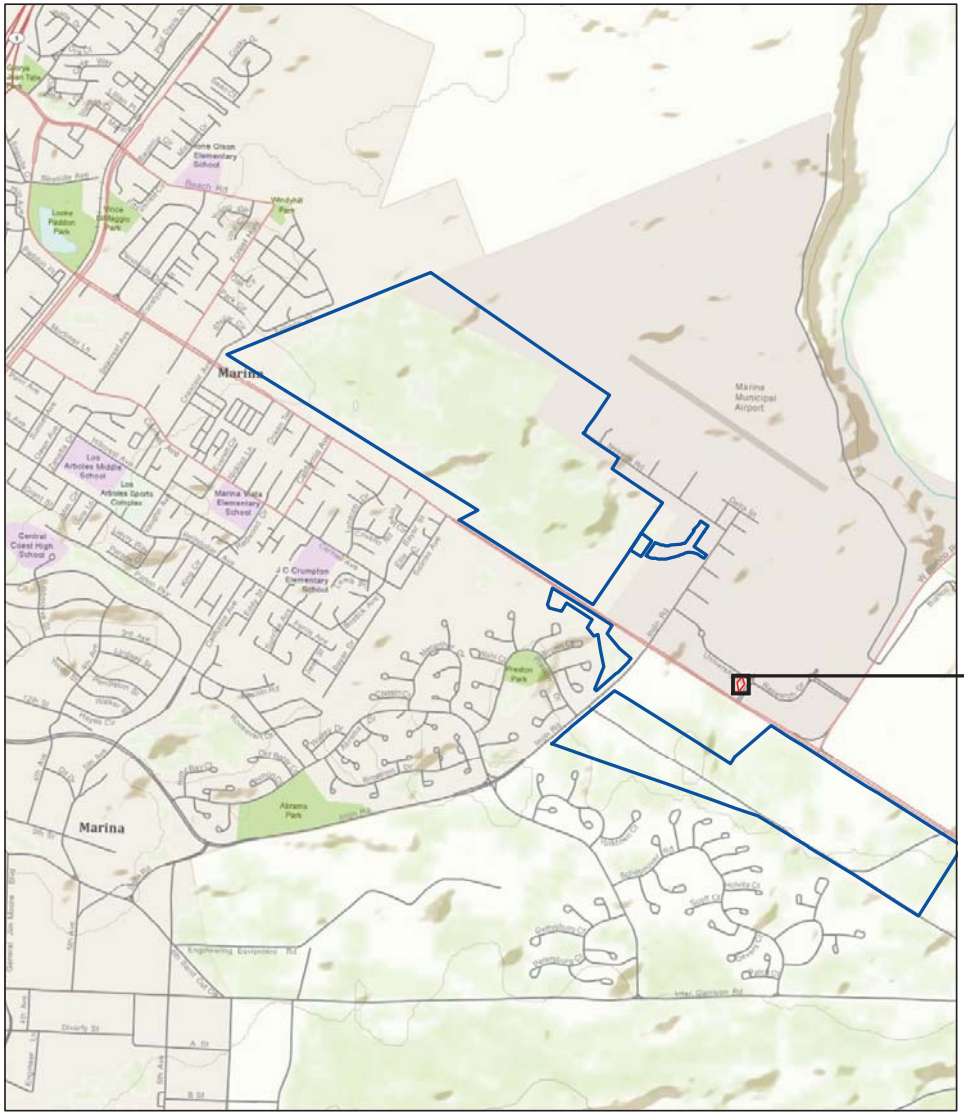


Figure A1.1

Project Vicinty Map

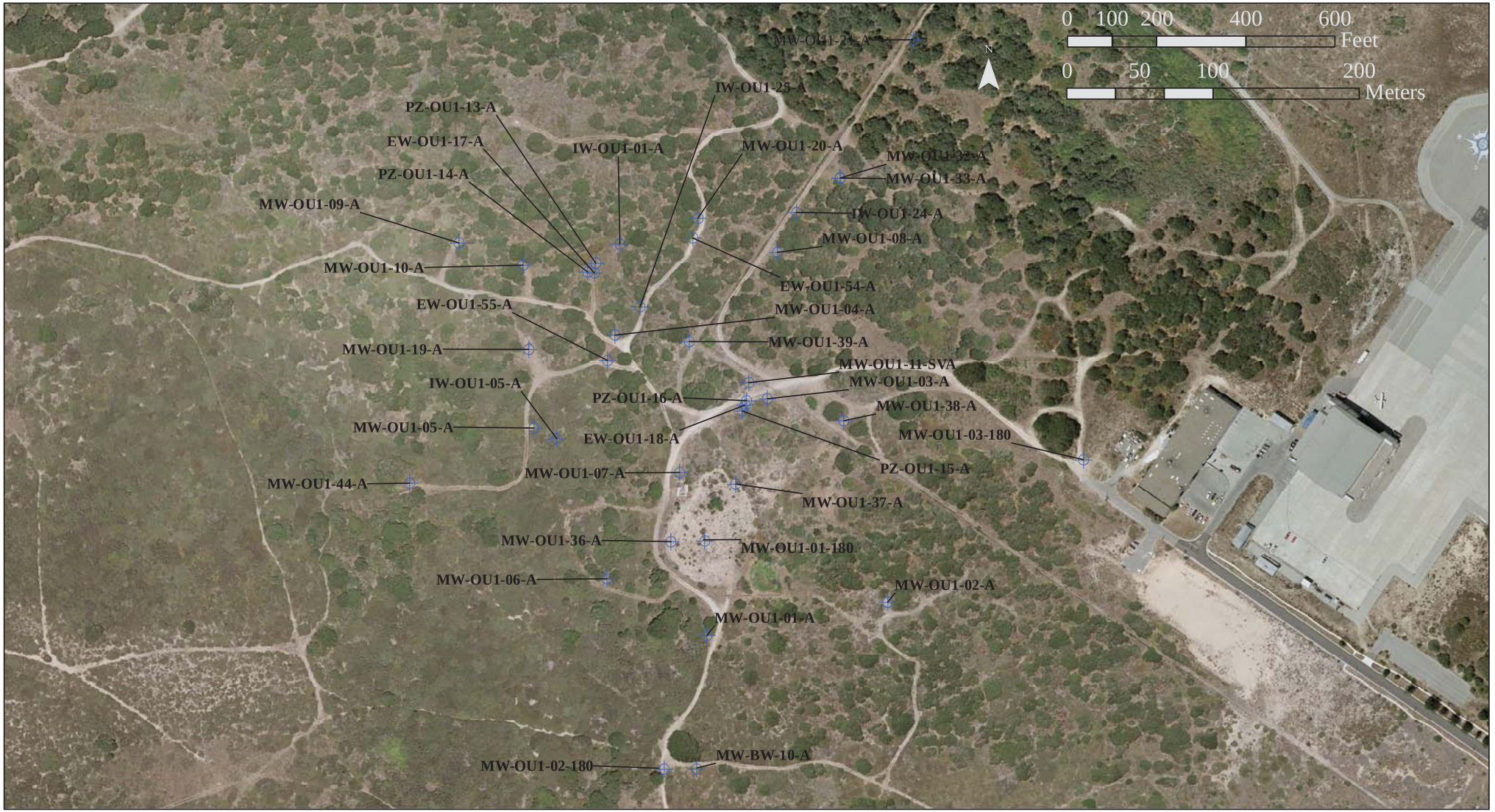


Survey Area

UC FONR Boundary

Figure A1.2

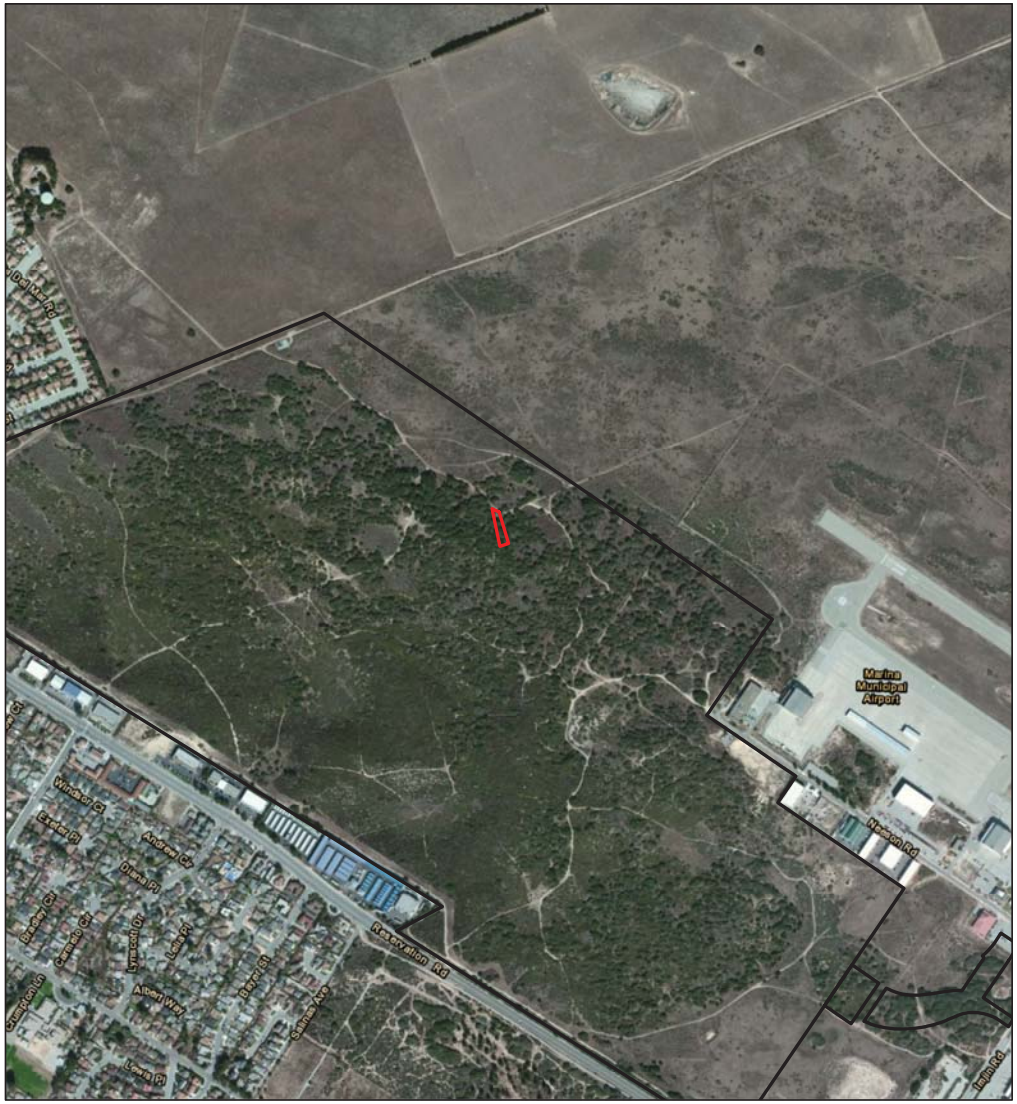
DD&A Reference Site Map



Destroyed Wells

Figure A1.3

OU-1 Wells Destroyed Within FONR in 2011



FONR Boundary

Well

2012 IW-OU1-10-A Survey Area

*Wells labeled in italic font were not surveyed during the 2011 survey effort.

Figure A1.4

2012 FONR-OU1
IW-OU1-10-A Survey Area

A2.0 Rare Plant Survey Methods

The survey areas consisted of the DD&A reference site outlined in Figure A1.2 and the OU1 FONR well locations shown on Figures A1.3 and A1.4. These areas were completely surveyed for the rare plants (i.e., Monterey spineflower and sand gilia) during three survey efforts conducted on April 16, 17, and 18, 2012.

Mapping of rare plant species was done using a Trimble Pathfinder ProXH GPS unit. When either rare plant was identified, the survey in that area was extended to the boundary of the population encountered. Large areas of Monterey spineflower and sand gilia were mapped as polygons, with attributes to identify number of individuals or percent absolute cover. Smaller groups and individuals were mapped as points with attributes to identify the number of individuals at each location.

Individual counts were made for all sand gilia populations whether they were mapped using points (population ≤5) or polygons (population ≥6). However, Monterey spineflower were only counted as individuals when groups of five or less were mapped. Monterey spineflower populations consisting of greater than five individuals were mapped as polygons and characterized according to the percent of cover. The categories used were:

- Very Sparse (corresponding to an absolute cover of less than 3 percent),
- Sparse (3-25 percent absolute cover),
- Medium Low (26-50 percent absolute cover),
- Medium (51-75 percent absolute cover),
- Medium High (76-97 percent absolute cover), and
- Very High (>97-100 percent absolute cover).

Locations were mapped using GPS units and data defining the population boundaries and/or point location(s) were exported to shapefile format. Shapefiles were imported for use in the Geographic Information System (GIS) ESRI ArcGIS and overlaid on high resolution aerial photography/satellite imagery. The populations identified for each species are shown on Figures A3.1, A3.2, and A3.3 and discussed below.

Monterey Spineflower Polygons

Sparse

Medium Low

Sand Gilia Polygons

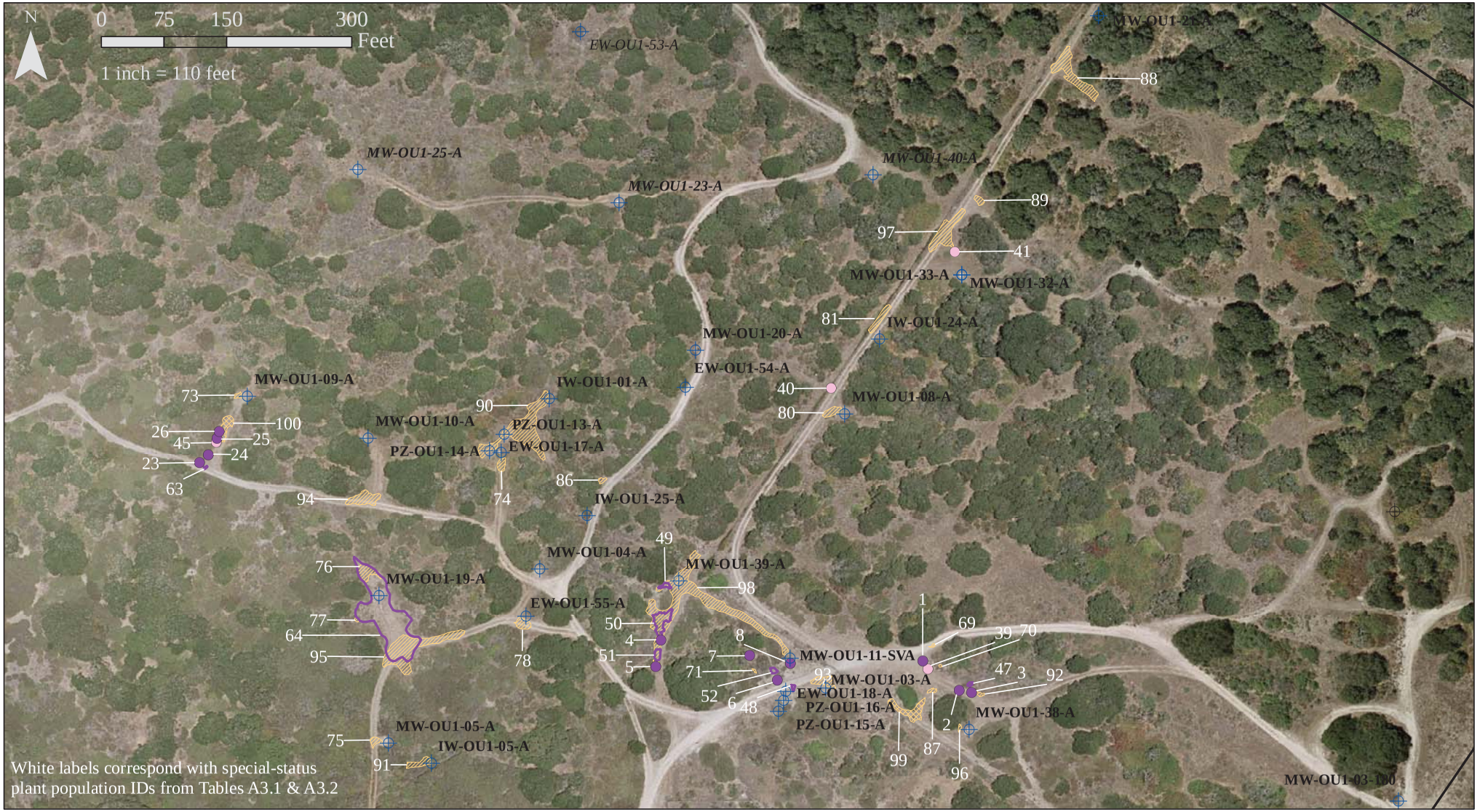
Survey Area

Monterey Spineflower Points

Sand Gilia Points

Figure A3.1

2012 Rare Plant Survey Results
DD&A Reference Area



Monterey Spineflower Polygons

- Sparse
- Medium Low

- Sand Gilia Polygons
- Sand Gilia Points
- Monterey Spineflower Points

**Wells labeled in italic font were not surveyed during 2012 survey effort.*

Figure A3.2

North 2012 Survey Area Rare Plant Population Locations

Monterey Spineflower Polygons

- Sparse
- Medium Low

- Sand Gilia Polygons
- Sand Gilia Points
- Monterey Spineflower Points

Figure A3.3

South 2012 Survey Area Rare Plant Population Locations

A3.0 Results

A3.1 Rare Plant Survey Results

A3.1.1 Sand Gilia

Sand gilia was observed and mapped at the DD&A reference site and the OU1 FONR well locations. In all, 60 populations (38 points and 22 polygons) of sand gilia were mapped within the DD&A reference site and OU1 FONR well locations. The discrete populations are listed in Table A3.1 and shown on Figures A3.1, A3.2, and A3.3. A total of 1,052 individual plants were mapped at the 60 populations.

A3.1.2 Monterey Spineflower

A total of 43 populations (eight points and 35 polygons) of Monterey spineflower were mapped at the DD&A reference site and the OU1 FONR well locations. The discrete populations are listed in Table A3.2 and shown on Figures A3.1, A3.2, and A3.3. Population size estimates for Monterey spineflower are not as easily quantified as the sand gilia populations, and, therefore, individual Monterey spineflower plants were not counted within the GIS polygons. As noted previously, populations of Monterey spineflower were categorized as a percentage of cover based on visual estimation. Of the 35 populations of Monterey spineflower that were mapped as polygons, five populations were Medium Low (26-50 percent cover) and 30 populations were identified as Sparse (3-25 percent cover).

Table A3.1 Sand Gilia Populations Identified During 2012 Survey

Population #	Number of Individuals	GIS Feature Type	Survey Date	Figure Number
1	3	Point	4/16/2012	**A3.2**
2	1	Point	4/16/2012	**A3.2**
3	1	Point	4/16/2012	**A3.2**
4	4	Point	4/16/2012	**A3.2**
5	1	Point	4/16/2012	**A3.2**
6	4	Point	4/16/2012	**A3.2**
7	1	Point	4/16/2012	**A3.2**
8	2	Point	4/16/2012	**A3.2**
9	1	Point	4/17/2012	**A3.3**
10	2	Point	4/17/2012	**A3.3**
11	1	Point	4/17/2012	**A3.3**
12	1	Point	4/17/2012	**A3.3**
13	2	Point	4/17/2012	**A3.3**
14	2	Point	4/17/2012	**A3.3**
15	1	Point	4/17/2012	**A3.3**
16	4	Point	4/17/2012	**A3.3**
17	1	Point	4/17/2012	**A3.3**
18	3	Point	4/17/2012	**A3.3**
19	1	Point	4/17/2012	**A3.3**
20	1	Point	4/17/2012	**A3.3**
21	1	Point	4/17/2012	**A3.3**
22	1	Point	4/17/2012	**A3.3**
23	4	Point	4/17/2012	**A3.2**
24	2	Point	4/17/2012	**A3.2**
25	1	Point	4/17/2012	**A3.2**
26	3	Point	4/17/2012	**A3.2**
27	1	Point	4/18/2012	**A3.1**
28	4	Point	4/18/2012	**A3.1**
29	1	Point	4/18/2012	**A3.1**
30	1	Point	4/18/2012	**A3.1**
31	1	Point	4/18/2012	**A3.1**
32	1	Point	4/18/2012	**A3.1**
33	2	Point	4/18/2012	**A3.1**
34	1	Point	4/18/2012	**A3.1**
35	1	Point	4/18/2012	**A3.1**
36	2	Point	4/18/2012	**A3.1**
37	4	Point	4/18/2012	**A3.1**
38	2	Point	4/18/2012	**A3.1**
47	10	Polygon	4/16/2012	**A3.2**
48	13	Polygon	4/16/2012	**A3.2**
49	18	Polygon	4/16/2012	**A3.2**
50	53	Polygon	4/16/2012	**A3.2**
51	13	Polygon	4/16/2012	**A3.2**
52	10	Polygon	4/16/2012	**A3.2**

53	17	Polygon	4/17/2012	**A3.3**
54	10	Polygon	4/17/2012	**A3.3**
55	10	Polygon	4/17/2012	**A3.3**
56	11	Polygon	4/17/2012	**A3.3**
57	18	Polygon	4/17/2012	**A3.3**
58	89	Polygon	4/17/2012	**A3.3**
59	18	Polygon	4/17/2012	**A3.3**
60	52	Polygon	4/17/2012	**A3.3**
61	14	Polygon	4/17/2012	**A3.3**
62	8	Polygon	4/17/2012	**A3.3**
63	7	Polygon	4/17/2012	**A3.2**
64	562	Polygon	4/17/2012	**A3.2**
65	7	Polygon	4/18/2012	**A3.1**
66	27	Polygon	4/18/2012	**A3.1**
67	6	Polygon	4/18/2012	**A3.1**
68	9	Polygon	4/18/2012	**A3.1**

Table A3.2 Monterey Spineflower Populations Identified During 2012 Survey

Population #	Number of Individuals or Percent Cover	Cover Class	Survey Date	Figure Number
39	2	N/A	4/16/2012	**A3.2**
40	1	N/A	4/16/2012	**A3.2**
41	3	N/A	4/16/2012	**A3.2**
42	1	N/A	4/17/2012	**A3.3**
43	3	N/A	4/17/2012	**A3.3**
44	1	N/A	4/17/2012	**A3.3**
45	1	N/A	4/17/2012	**A3.2**
46	4	N/A	4/18/2012	**A3.1**
69	5%	Sparse	4/16/2012	**A3.2**
70	5%	Sparse	4/16/2012	**A3.2**
71	5%	Sparse	4/16/2012	**A3.2**
72	5%	Sparse	4/17/2012	**A3.3**
73	5%	Sparse	4/17/2012	**A3.2**
74	5%	Sparse	4/17/2012	**A3.2**
75	5%	Sparse	4/17/2012	**A3.2**
76	5%	Sparse	4/17/2012	**A3.2**
77	5%	Sparse	4/17/2012	**A3.2**
78	5%	Sparse	4/17/2012	**A3.2**
79	5%	Sparse	4/18/2012	**A3.1**
80	10%	Sparse	4/16/2012	**A3.2**
81	10%	Sparse	4/16/2012	**A3.2**
82	10%	Sparse	4/17/2012	**A3.3**
83	10%	Sparse	4/17/2012	**A3.3**
84	10%	Sparse	4/17/2012	**A3.3**
85	10%	Sparse	4/18/2012	**A3.1**
86	15%	Sparse	4/16/2012	**A3.2**
87	15%	Sparse	4/16/2012	**A3.2**
88	15%	Sparse	4/16/2012	**A3.2**
89	15%	Sparse	4/16/2012	**A3.2**
90	15%	Sparse	4/17/2012	**A3.2**
91	15%	Sparse	4/17/2012	**A3.2**
92	20%	Sparse	4/16/2012	**A3.2**
93	20%	Sparse	4/16/2012	**A3.2**
94	20%	Sparse	4/17/2012	**A3.2**
95	20%	Sparse	4/17/2012	**A3.2**
96	25%	Sparse	4/16/2012	**A3.2**
97	25%	Sparse	4/16/2012	**A3.2**
98	25%	Sparse	4/16/2012	**A3.2**
99	30%	Medium Low	4/16/2012	**A3.2**
100	30%	Medium Low	4/17/2012	**A3.2**
101	30%	Medium Low	4/17/2012	**A3.3**
102	35%	Medium Low	4/17/2012	**A3.3**
103	40%	Medium Low	4/17/2012	**A3.3**

A4.0 Conclusions

A4.1 Comparisons

As required by the HMP, surveys are conducted for three years after the disturbance occurs in areas that are disturbed during the remediation effort. This section compares the results of the 2012 rare plant survey within the DD&A reference area and the OU1 FONR property with previous surveys in the same areas. Many of the well locations mapped during 2012 were constructed during or before the year 2000 and before the survey schedule in the HMP was implemented. As a result of this time lapse, the comparison section of the 2011 OU1 FONR rare plant report was limited to comparisons between a subset of the well locations that were surveyed in 2007. To remain consistent, the 2012 rare plant comparison analysis will compare the same well location subset used to compare the 2007 and 2011 rare plant surveys with the survey data recorded during the 2012 rare plant survey. Additionally, this rare plant survey report will compare the results of the 2012 survey with the results of the 2011 survey for all wells surveyed within OU1 FONR. The reference area was not surveyed in 2007 and, therefore, the comparisons within the reference area are restricted to the surveys conducted in 2011 and 2012.

The well locations included in the 2007 rare plant surveys are listed below. All of these wells were installed during 2004 as part of HGL's initial construction effort.

EW-OU1-54-A	IW-OU1-24-A	IW-OU1-01-A
IW-OU1-25-A	EW-OU1-55-A	IW-OU1-05-A

The 2007 rare plant survey also included roadways and staging areas adjacent to the well locations listed below. These wells were installed between 1986 and 1999.

EW-OU1-17-A	PZ-OU1-13-A	PZ-OU1-14-A
EW-OU1-18-A	PZ-OU1-15-A	PZ-OU1-16-A
MW-OU1-11-SVA	MW-OU1-03-A	MW-OU1-38-A
MW-OU1-07-A	MW-BW-10-A	MW-OU1-05-A

The preceding list of well locations comprises the OU1 FONR well location subset used to compare rare plant surveys from 2007, 2011, and 2012

A5.1 DD&A Reference Site

In 2011, 16 populations of sand gilia (four polygons and 12 points) were mapped within the DD&A reference area. A total of 318 individual plants were mapped at the 16 populations. In 2012, 16 populations with a total of 70 individual sand gilia plants (four polygons and 12 points) were mapped within the DD&A reference area. The sand gilia polygons covered approximately 1,409.5 square feet (ft^2) in 2011, and approximately 209.6 ft^2 in 2012, a decrease of 1,199.9 ft^2.

The most significant change in sand gilia cover was located in the middle of the reference area. Sand gilia observed during the 2012 survey effort was substantially less when compared to the 2011 survey effort. The reference area is located on property that is relatively undisturbed by anthropogenic activities. Sand gilia fluctuate in a given year because of natural variation in rainfall, temperature, and other factors. Given the low numbers found at this undisturbed reference site, it is likely that the environmental factors necessary to yield abundant populations of sand gilia were not ideal in 2012.

One population (Sparse polygon) of Monterey spineflower was mapped at the DD&A reference site in 2011. Three Monterey spineflower populations (two Sparse polygons and one point) were mapped within the DD&A reference area in 2012. The Monterey spineflower polygons covered approximately 2,865.4 ft^2 in 2011 and approximately 1,493.5 ft^2 in 2012. This difference of 1,371.9 ft^2 is substantially more than the difference between 2010 and 2011 (19.3 ft^2). As mentioned above for sand gilia, there are several environmental factors that are responsible for the amount of Monterey spineflower that blooms in a given year. The reference site is relatively undisturbed and, therefore, it is likely that the environmental factors necessary to yield abundant populations of Monterey spineflower were not ideal in 2012.

A5.2 OU1 FONR (Well Subset Comparison)

As described in the methods section, some populations of Monterey spineflower and sand gilia extend beyond the immediate vicinity of a well and are recorded as populations residing outside of the OU1 FONR well locations. To remain consistent, this analysis includes only polygons or points that are within approximately 30 feet of the well locations. At the subset of 18 well locations described above, seven polygons of Monterey spineflower (all Sparse cover class) totaling 3,352.3 ft^2 were mapped during the 2007 rare plant surveys. No Monterey spineflower points were recorded within approximately 30 feet of the 18 surveyed well locations in 2007. During the 2011 survey effort, 13 polygons of Monterey spineflower (one Medium Low and 12 Sparse cover class), totaling 6,948.1 ft^2, were mapped. Also recorded were five point locations of Monterey spineflower, totaling 17 individuals. In 2012, 10 polygons of Monterey spineflower were mapped in the same survey areas (all Sparse cover class) totaling 6,401.3 ft^2—a decrease of 546.8 ft^2 when compared to 2011, however an increase of 3,049 ft^2 when compared to 2007. No point locations of Monterey spineflower were recorded. Monterey spineflower was found at 12 of the 18 well locations surveyed in 2007, 17 of the 18 well locations surveyed in 2011 and at 12 of the 18 well locations in 2012.

At the 18 well locations described above, three polygons of sand gilia totaling 559.6 ft^2 (212 individuals) were recorded during the 2007 rare plant surveys. Also recorded were five point locations of sand gilia, totaling nine individual plants. During the 2011 rare plant surveys at the locations described above, one polygon of sand gilia totaling, 30.9 ft^2 (18 individuals) was recorded. Also recorded were 13 point locations of sand gilia totaling 45 individual plants. In 2012, two polygons of sand gilia totaling 50.3 ft^2 (23

individuals) were recorded —an increase of 19.4 ft^2 when compared to 2011 and a decrease of 509.3 ft^2 when compared to 2007. Additionally, five points of sand gilia totaling 10 individuals were mapped in the same survey areas in 2012. Sand gilia was found at six of the 18 well locations during the 2007 survey, six of the 18 well locations during the 2011 survey, and in 2012, sand gilia was detected at four of the 18 well locations.

A5.3 OU1 FONR (All Well Locations Comparison)

The results for Monterey spineflower for all well locations on the OU1 FONR property surveyed during the 2011 and 2012 survey efforts showed:

- In 2011, 33 polygons of Monterey spineflower (one Medium-High, one Medium, four Medium Low and 27 Sparse cover class) totaling 29,746.4 ft^2 were mapped. In addition, 11 Monterey spineflower points were mapped totaling 33 plants.
- In 2012, 33 polygons of Monterey spineflower were mapped (five Medium Low and 28 Sparse cover class) totaling 12,787.2 ft^2—a decrease of 16,959.2 ft^2. Seven point locations of Monterey spineflower totaling 12 individuals also were recorded.
- Monterey spineflower was found at 31 of the 40 well locations surveyed in 2011 and at 21 of the 40 well locations in 2012.

The results for sand gilia for all well locations on the OU1 FONR property surveyed during the 2011 and 2012 survey efforts showed:

- In 2011, nine polygons of sand gilia totaling 7,463.3 ft^2 (1140 individuals) were recorded during the 2011 rare plant surveys. In addition, 40 points of sand gilia, totaling 122 individual plants were recorded.
- In 2012, 18 polygons of sand gilia totaling 5,720.9 ft^2 (933 individuals) and 26 points of sand gilia totaling 49 individuals were mapped. The total area of sand gilia polygons decreased 1,742.4 ft^2 from 2011 to 2012. Total individual counts of sand gilia decreased from 1262 in 2011 to 982 in 2012, a difference of 280 sand gilia individuals.
- Sand gilia was found at 9 of the 40 well locations during both surveys.
- During 2011 and 2012 sand gilia was found at the following six well locations:
  MW-OU1-09-A, MW-OU1-19-A, MW-OU1-39-A, EW-OU1-18-A, MW-OU1-38-A and MW-OU1-02-A
- In 2011, sand gilia was also found at these three well locations:
  MW-OU1-54-A, PZ-OU1-15-A and PZ-OU1-16-A
- In 2012, sand gilia was also found at these three well locations:
  MW-OU1-06-A, MW-OU1-01-A and MW-OU1-10-A

A5.4 Population Sustainability

More sand gilia populations were recorded than Monterey spineflower populations (60 locations compared to 43 locations of Monterey spineflower) during the 2012 survey effort. DD&A conducted rare plant surveys from 2006-2012 within the OU1 FONR area,

and the 2012 rare plant survey was the second year in which sand gilia populations outnumbered Monterey spineflower populations.

Sand gilia at the OU1 FONR well locations have historically fluctuated because of natural variation in rainfall, temperature, and other factors. An example of this fluctuation at OU1 FONR was observed during the 2006 survey effort. The 2006 survey found 40 sand gilia plants in five areas at the west end of Survey Site 6; an area north of the well locations surveyed in 2012. Based on their presence in 2006, HGL avoided activity in this area and re-located the well that was originally proposed at this location approximately 180 feet to the east. However, none of the populations observed in 2006 were found in subsequent years. The annual survey data at this location illustrates population fluctuations in an area that was not impacted by human disturbance.

Monterey spineflower populations are relatively abundant and seem to be less affected by the same environmental factors or constraints as sand gilia. Previous rare plant surveys conducted by DD&A indicate that populations of Monterey spineflower were often observed in areas with sparse to moderately abundant non-native annual grass cover. These observations suggest that this species may be somewhat more tolerant of competing annual grass cover than sand gilia.

The survey data shows that both Monterey spineflower and sand gilia within the surveyed portion of the OU1 FONR survived the earlier construction efforts.

A5.0 References

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U.S. Army Corps of Engineers, Sacramento District. 1997. Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California. April 1997. Sacramento, CA.

2012 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS OPERABLE UNIT 1 FORMER FORT ORD, CALIFORNIA

Appendix B
Report on Weed Control Segment Treatments Spring 2012

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OPERABLE UNIT 1 (OU-1)

2012 WEED CONTROL SEGMENT TREATMENT REPORT

UNIVERSITY OF CALIFORNIA - FORT ORD NATURAL RESERVE

SPRING 2012

Prepared for:

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TABLE OF CONTENTS

TABLES

ATTACHMENTS

Introduction

Weed control efforts continued on HydroGeoLogic, Inc. (HGL) work sites within the Operable Unit 1 (OU-1) portion of the Fort Ord Natural Reserve (FONR) in 2012. Weed control work was similar to the 2011 efforts and emphasized control of non-native grasses before they were able to establish in habitat disturbed by groundwater clean-up activities. Comprehensive vegetation surveys (e.g. species composition and cover data) of Weed Control Segments (WCS) were not conducted in 2012, which is consistent with the 2008- 2011 weed control efforts. It is our opinion that these comprehensive vegetation surveys are not necessary each year. Rather, vegetation surveys are intended to evaluate success of WCS treatments, which might not be evident within one year. This report summarizes the 2012 weed control efforts, data collection and survey results.

Methods

WCS treatments began 29 March 2012 and continued through 17 July 2012. Each WCS received 1-3 treatments (weedeater and hand pulling) depending on site-specific phenology, response to treatments, and species composition. One WCS (9B) received three treatments, eight WCS (1A, 5A, 6A, 8A, 9A, 9C, 9D, 13A) were treated twice, and fifteen WCS (2A, 3A, 4A, 7A, 10A, 10B, 11A, 11B, 12A, 12B, 14A, 15A, 16A, 17A, 18A) received only one treatment. Prior to the initial treatment, rare plant surveys were conducted within each WCS. In addition, pre-treatment photos were taken from photo stations within each WCS. After performing a treatment, a WCS treatment record and a WCS treatment diagram were completed. The WCS treatment record includes: treatment date, treatment method(s), species treated, treatment duration, photo stations, and any additional notes about the site or treatment. The WCS treatment diagram includes the extent of the treatment and the species treated within the site. These diagrams, although not drawn to scale, also show the spatial extent, well location, well site/road boundaries, and photo stations/points for each

WCS. After performing the final treatment of the season, post-treatment photos were taken from appropriate photo stations within each WCS.

Results

The 2012 weed control program significantly reduced the survivorship, abundance, and seed production of target species in areas disturbed by OU-1 cleanup activities. Pre-treatment rare plant surveys (Attachment 2) identified locations of rare plants prior to treatments. Thus, we were able to avoid areas with protected species and ensure they were not negatively impacted by treatments. The results of the rare plant surveys (Table 3) show that sand gilia (*Gilia tenuiflora ssp. arenaria*) was present in 1 WCS (6A) and Monterey spineflower (*Chorizanthe pungens var. pungens*) were present in 18 WCS. Treatment details for each WCS are summarized in Tables 1 & 2. Along with this report, we have included the following documentation as attachments:

- treatment diagrams (described above; Attachment 1)
- rare plant survey data (Attachment 2)
- rare plant survey diagrams (Attachment 3)
- detailed photo log (Attachment 4)
- pre- & post treatment photos (Attachment 5)
    - Powerpoint file with photos formatted for printing
    - Original digital photo files (.jpgs) included on compact disc)

Discussion

Early spring implementation enabled us to effectively utilize mechanical methods to control non-native annual grasses and forbs. Both mechanical and hand control methods were utilized making the weed control efforts more effective, broad scale and sensitive to rare species habitat.

Multiple treatments were focused on high priority sites, with prioritization based on habitat type, rare plant presence, and weed species composition. Pre-treatment rare plant surveys identified 10 m^2 of sand gilia occupied habitat and 888 m^2 of Monterey spineflower occupied habitat. These pre-treatment surveys are essential to ensure mechanical weed treatments do not have a negative impact on protected species. Because weed control efforts were initiated at the appropriate time, we were able reduce seed production of a significant portion of non-native annual grasses in locations where control was critical (i.e. within or adjacent to chaparral and scrub habitat). The continued removal of invasive forbs resulted in a reduction of thousands of invasive weeds from the well sites that may have otherwise expanded their distribution into FONR and increased their seed bank in areas disturbed by OU-1 clean-up activities. It is difficult to determine with measureable certainty if the relatively low weed abundance observed this year is a result of annual variation, climate conditions, or effective weed control. However, we are confident the weed abatement efforts are having a positive impact on reducing weed populations on the OU-1 cleanup sites. As a result, our efforts have reduced the number of invasive plants and, very importantly, removed a large portion of the invasive weed seed source for 2013.

Table 1. Summary of Weed Control Segment (WCS) treatments, spring 2012.

WCS	Well ID	# of Treatments	Treatment Method	Species Treated	Rare Plants Present	WCS of High Concern**
1A	NA – Staging Area	2	manual, mechanical	acsp, brdi, brmaru, ersp, hyso, mepo, plco, ruac, trsp, vusp	Y	
2A	NA – Staging Area	1	mechanical	aica, avsp, brmaru, brdi, cema, coma, ersp, mepo trsp	Y	
3A	NA – Staging Area	1	mechanical	brdi, brmaru, ersp, hysp, ruac, trsp, vusp	N	
4A	IW-OU1-05-A	1	mechanical	brmaru, vusp	Y	*
5A	IW-OU1-01-A	2	manual, mechanical	aica, avsp, brca, brdi, brho, brmaru, cema, ersp, hysp, sima, vusp	Y	*
6A	EW-OU1-53-A	2	manual, mechanical	aica, avsp, brca, brdi, brho, brmaru, coma, ersp, hysp, ruac, sool, vusp	Y	*
7A	EW-OU1-52-A	1	mechanical	anar, brca, brdi, brho, brmaru, ersp, sool, vusp	Y	
8A	IW-OU1-10-A, PZ-OU1-10-A2	2	manual, mechanical	aica, avsp, brca, brdi, brho, brimax, coma, eher, ersp, hysp, plco, ruac, sool, vusp,	N	
9A	MW-OU1-46-A MW-OU1-46-AD PZ-OU1-46-AD2	2	mechanical	aica, anar, brdi, brho, brmaru, coma, ersp, ruac, vusp	Y	
9B	MW-OU1-84-A	3	manual, mechanical	aica, anar, avsp, brca, brdi, brho, brmaru, coma, cema, ersp, hysp, ruac, vusp,	Y	
9C	MW-OU1-50-A	2	mechanical	aica, anar, avsp, brdi, brmaru, coma, ersp, hysp, ruac, sool, vusp,	Y	*
9D	MW-OU1-51-A	2	mechanical	avsp, brca, brdi, brho, brmaru, ersp, hysp, ruac	Y	*
10A	MW-OU1-50-A	1	mechanical	aica, avsp, brca, brdi, brho, brmaru, ersp, hysp, vusp,	Y	
10B	MW-OU1-59-A	1	mechanical	anar, brca, brdi, brho, brmaru, capy, ersp, hosp, hysp, ruac, vusp	Y	
11A	IW-OU1-71-A	1	mechanical	avsp, brdi, brimax, hysp, ersp, mepo, plco, ruac, vusp	Y	
11B	EW-OU1-86-A	1	mechanical	avsp, brdi, brimax, brmaru, ersp, hysp, ruac, vusp	N	
12A	EW-OU1-72-A	1	mechanical	brdi, brho, brimax, brmaru, coma, ersp, hysp, vusp,	N	

WCS	Well ID	# of Treatments	Treatment Method	Species Treated	Rare Plants Present	WCS of High Concern**
12B	MW-OU1-85-A	1	mechanical	aica, avsp, brdi, brca, brimax, brmaru, hysp, sool, vusp	Y	
13A	IW-OU1-73-A	2	mechanical	avsp, brdi, brho, brimax, brmaru, ersp, hysp, mepo, ruac, vusp	Y	*
14A	MW-OU1-83-A	1	mechanical	anar, avsp, brca, brdi, brho, brmaru, ersp, ruac, sool, vusp	Y	*
15A	MW-OU1-82-A	1	mechanical	aica, anar, avsp, brca, brdi, brho, brmaru, hysp, ersp, vusp	Y	*
16A	SB-OU1-2004-K	1	mechanical	aica, anar, avsp, brca, brdi, brho, brmaru, capy, coma, hysp, ruac	Y	*
17A	PZ-OU1-02-A IW-OU1-02-A	1	mechanical	aica, avsp, brca, brdi, brho, brmaru, cema, coma, ersp, hysp, plco, ruac, vusp	N	
18A	MW-OU1-88A	1	mechanical	avsp, brca, brdi, brho, brimax, brmaru, cema	N	

**** WCS of High Concern**– this classification represents a subjective judgment based on a number of factors, including (among others) the number and frequency of treatments, observed response to treatments, and the species composition of the site.

Table 2. Invasive species treated within the 22 Weed Control Segments (WCS), spring 2012.

Genus	Species	Code	Common Name
Aira	*caryophyllea*	aica	slivery hair-grass
Anaglis	*arvensis*	anar	scarlet pimpernel
Anthriscus	*caucalis*	anca	bur-chervil
Avena	species	avsp	wild oat species (Note: species not identified – avsp includes both *Avena barbata* and *A. fatua*)
Briza	*maxima*	brimax	rattlesnake grass
Bromus	*catharticus*	brca	prairie grass
Bromus	*diandrus*	brdi	ripgut grass
Bromus	*hordeaceus*	brho	soft chess
Bromus	*madritensis ssp. rubens*	brmaru	red brome
Carpobrotus	*edulis*	caed	iceplant, hottentot fig
Carduus	*pycnocephalis*	capy	Italian thistle
Conium	*maculatum*	coma	poison hemlock
Erodium	species	ersp	Erodium species (Note: species not identified – ersp includes *Erodium botrys, Erodium brachycarpum, Erodium cicutarium* and *Erodium moschatum*)
Ehrharta	*Erecta*	eher	panic veldtgrass, erect veldtgrass
Hordeum	*vulgare*	hovu	common barley
Hypochaeris	species	hysp	cats ear species (Note: species not identified – hysp includes both *Hypochaeris glabra* and *H. radicata)*
Medicago	*polymorpha*	mepo	bur clover
Oxalis	*pes-caprae*	oxpe	Bermuda buttercup
Plantago	*coronopus*	plco	cut-leaved plantain
Rumex	*acetosella*	ruac	sheep sorrel
Silybum	*marianum*	sima	milk thistle
Sonchus	*oleraceus*	sool	common sowthistle
Trifolium	species	trsp	clover species (Note: species not identified/need positive identification – trsp includes field clover (*Trifolium campestre)* and woolly clover (*Trifolium tomentosum*)
Vulpia	species	vusp	fescue species (Note: species not identified – vusp includes *Vulpia bromoides, V. myuros var. hirsute,* and *V. myuros var. myuros*)

Table 3. Summary Weed Control Segment (WCS) rare plant surveys, spring 2011.

WCS	Well ID	Rare Plant Species Present	# Patches within WCS	Total Occupied Area (m^2)	Patch Density/Coverage & Patch Area Sub-total
1A	NA – Staging Area	*Chorizanthe pungens* var. *pungens*	14	31	2 patches – Sparse / 10 m^2 12 patches Very Sparse / 21 m^2
2A	NA – Staging Area	*Chorizanthe pungens* var. *pungens*	12	36	1 patch – High / 8 m^2 2 patches – Medium / 11 m^2 1 patch – Sparse / 5 m^2 8 patches Very Sparse / 12 m^2
4A	IW-OU1-05-A	*Chorizanthe pungens* var. *pungens*	14	44	2 patches – High / 9 m^2 2 patches – Medium / 9 m^2 3 patches – Sparse / 11 m^2 7 patches Very Sparse / 15 m^2
5A	IW-OU1-01-A	*Chorizanthe pungens* var. *pungens*	45	147	1 patch – Very High / 1 m^2 6 patches – High / 44 m^2 10 patches – Medium / 41 m^2 13 patches – Sparse / 31 m^2 15 patches Very Sparse / 30 m^2
6A	EW-OU1-53-A	*Gilia tenuiflora ssp. arenaria*	10	10	6 patches – Low / 6 m^2 4 patches Very Low / 4 m^2
		Chorizanthe pungens var. *pungens*	12	67	1 patch – High / 30 m^2 4 patches Medium / 15 m^2 2 patches - Sparse / 12 m^2 5 patches - Very Sparse / 10 m^2
7A	EW-OU1-52-A	*Chorizanthe pungens* var. *pungens*	2	2	2 patches - Very Sparse / 2 m^2
9A	MW-OU1-46-A MW-OU1-46-AD PZ-OU1-46-AD2	*Chorizanthe pungens* var. *pungens*	22	118	2 patches – High / 41 m^2 6 patches – Medium / 45 m^2 7 patches - Sparse / 16 m^2 7 patches - Very Sparse / 16 m^2
9B	MW-OU1-84-A	*Chorizanthe pungens* var. *pungens*	10	35	1 patch – Medium / 9 m^2 1 patch - Sparse / 2 m^2 8 patches - Very Sparse / 24 m^2

WCS	Well ID	Rare Plant Species Present	# Patches within WCS	Total Occupied Area (m^2)	Patch Density/Coverage & Patch Area Sub-total
9C	MW-OU1-50-A	*Chorizanthe pungens* var. *pungens*	15	71	3 patches – Medium / 26 m^2 4 patches - Sparse / 22 m^2 8 patches - Very Sparse / 23 m^2
9D	MW-OU1-51-A	*Chorizanthe pungens* var. *pungens*	2	27	1 patch - Medium / 12 m^2 1 patch - Sparse / 15 m^2
10A	MW-OU1-50-A	*Chorizanthe pungens* var. *pungens*	17	107	1 patch – Very High / 5 m^2 3 patches – High / 44 m^2 6 patches – Medium / 35 m^2 5 patches – Sparse / 19 m^2 2 patches Very Sparse / 4 m^2
10B	MW-OU1-59-A	*Chorizanthe pungens* var. *pungens*	16	42	4 patches – Medium / 18 m^2 4 patches - Sparse / 10 m^2 8 patches Very Sparse / 14 m^2
11A	IW-OU1-71-A	*Chorizanthe pungens* var. *pungens*	5	12	4 patches – Medium / 18 m^2 4 patches - Sparse / 10 m^2 2 patches - Very Sparse / 2 m^2
12B	MW-OU1-85-A	*Chorizanthe pungens* var. *pungens*	2	8	2 patches - Sparse / 8 m^2
13A	IW-OU1-73-A	*Chorizanthe pungens* var. *pungens*	1	1	1 patch - Very Sparse / 1 m^2
14A	MW-OU1-83-A	*Chorizanthe pungens* var. *pungens*	16	107	1 patch – Very High / 3 m^2 3 patches - High / 23 m^2 6 patches – Medium / 46 m^2 3 patches - Sparse / 25 m^2 3 patches - Very Sparse / 10 m^2
15A	MW-OU1-82-A	*Chorizanthe pungens* var. *pungens*	19	22	1 patch - Sparse / 2 m^2 18 patches - Very Sparse / 20 m^2
16A	SB-OU1-2004-K	*Chorizanthe pungens* var. *pungens*	4	11	1 patch – Medium / 6 m^2 1 patch - Sparse / 3 m^2 2 patches - Very Sparse / 2 m^2

Attachment 1

‘TREATMENT DIAGRAMS 2012’

The attached diagrams show the extent of the treatment and the species treated within each Weed Control Segment (WCS) for the 2012 weed control program within the Operable Unit 1 portion of the FONR. These diagrams (not drawn to scale) also show the spatial extent, well location, well site/road boundaries, and photo stations/points for each Weed Control Segment.

Well Site/Road Diagram

Well ID: N/A

WCS Sub Group 1A

Total Aprox. Area 2,480 (m²)

Well Rd. Area ____ (m²)

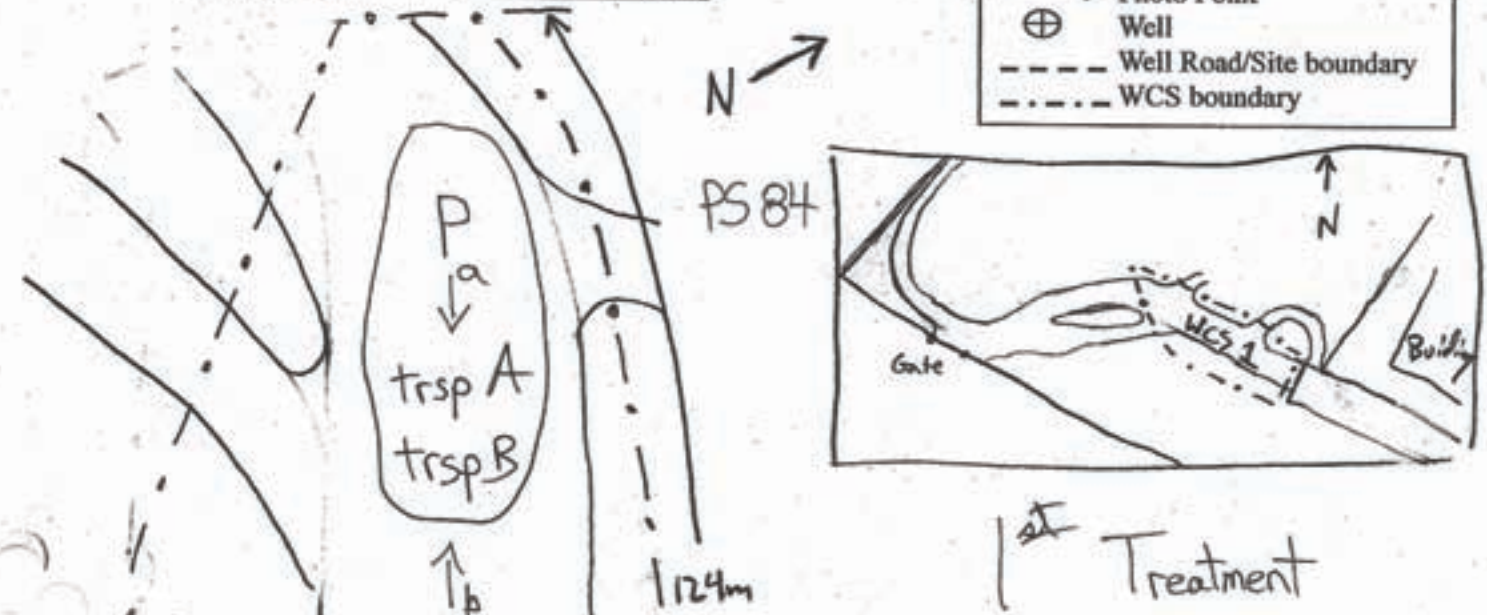
Well Site Area N/A (m²)

Date 3-29-2012

Surveyor STM, MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



1st Treatment

trspA : Trifolium species A? Unknown?

trspB : Trifolium species B - Verify - T. campestre

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well Site/Road Diagram

Well ID: N/A

WCS Sub Group 1

Total Aprox. Area 2480 (m²)

Well Rd. Area (m²)

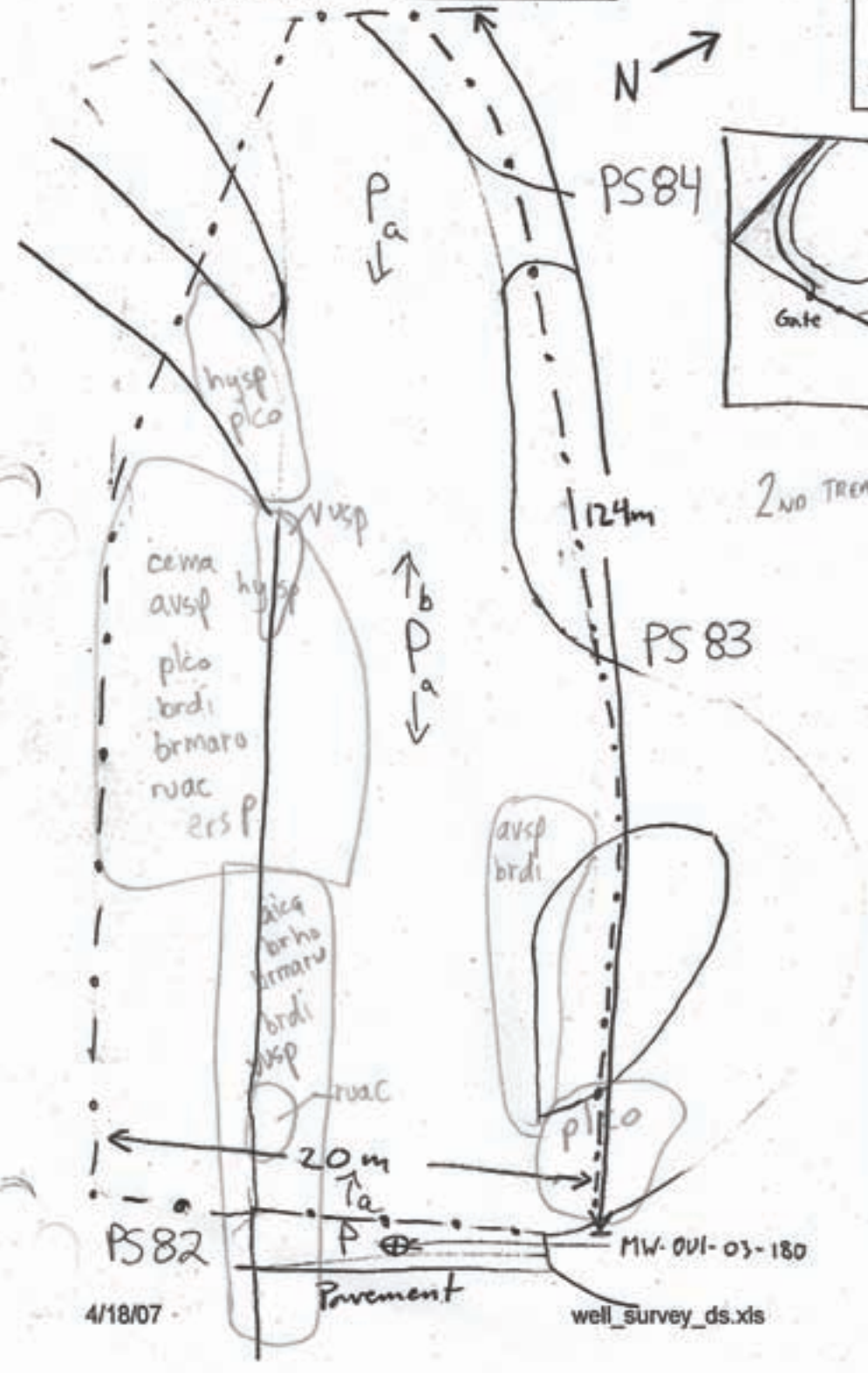
Well Site Area N/A (m²)

Date 5/24/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well Site/Road Diagram

Well ID: N/A

WCS Sub Group 2

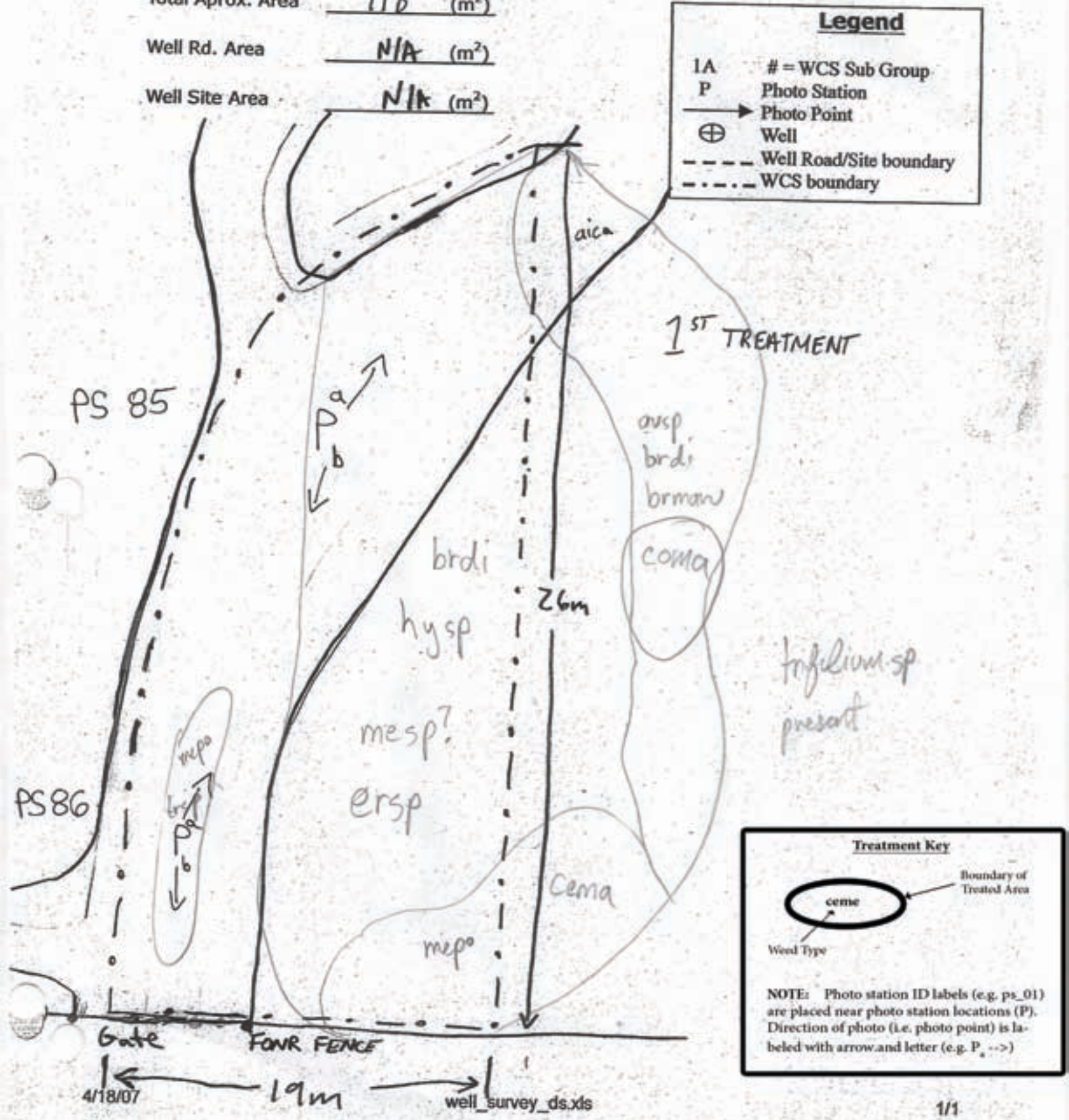
Total Aprox. Area 418 (m^2)

Well Rd. Area N/A (m^2)

Well Site Area N/A (m^2)

Date 5/23/12

Surveyor MNB



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well Site/Road Diagram

Well ID: N/A

WCS Sub Group 3

Total Aprox. Area 1,000 (m^2)

Well Rd. Area N/A (m^2)

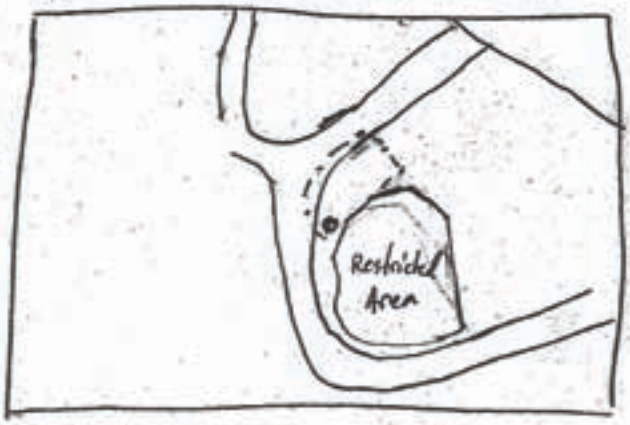
Well Site Area N/A (m^2)

Date 5/24/12

Surveyor MNB

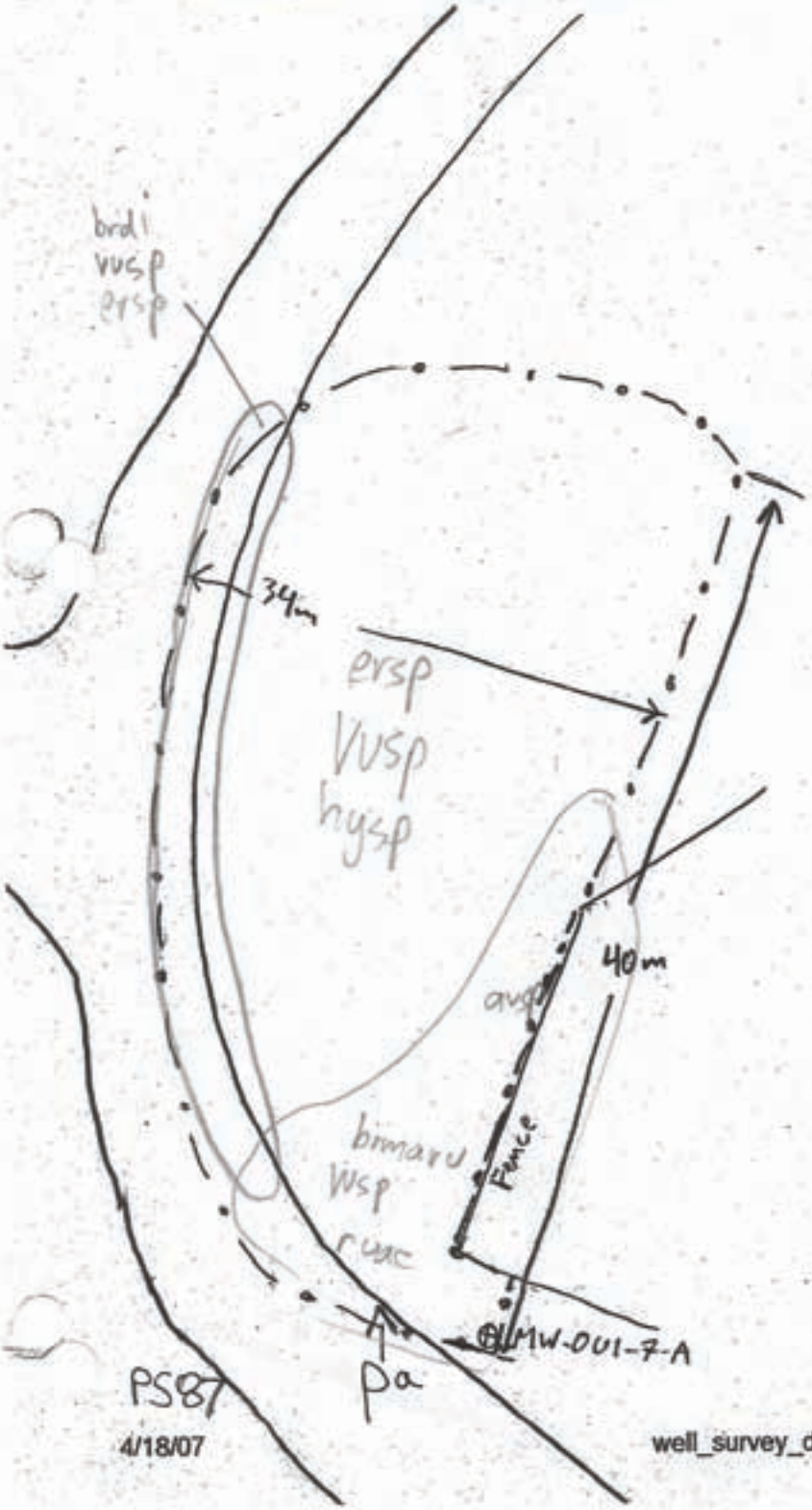
Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

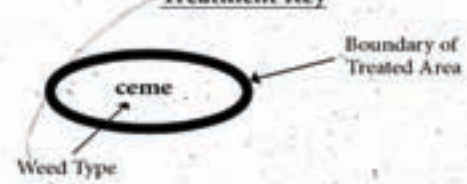


RARE PLANT SURVEY
(N.A.)

1ST TREATMENT



Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-05A

Date 5/23/12

WCS Sub Group 4A

Surveyor MNB

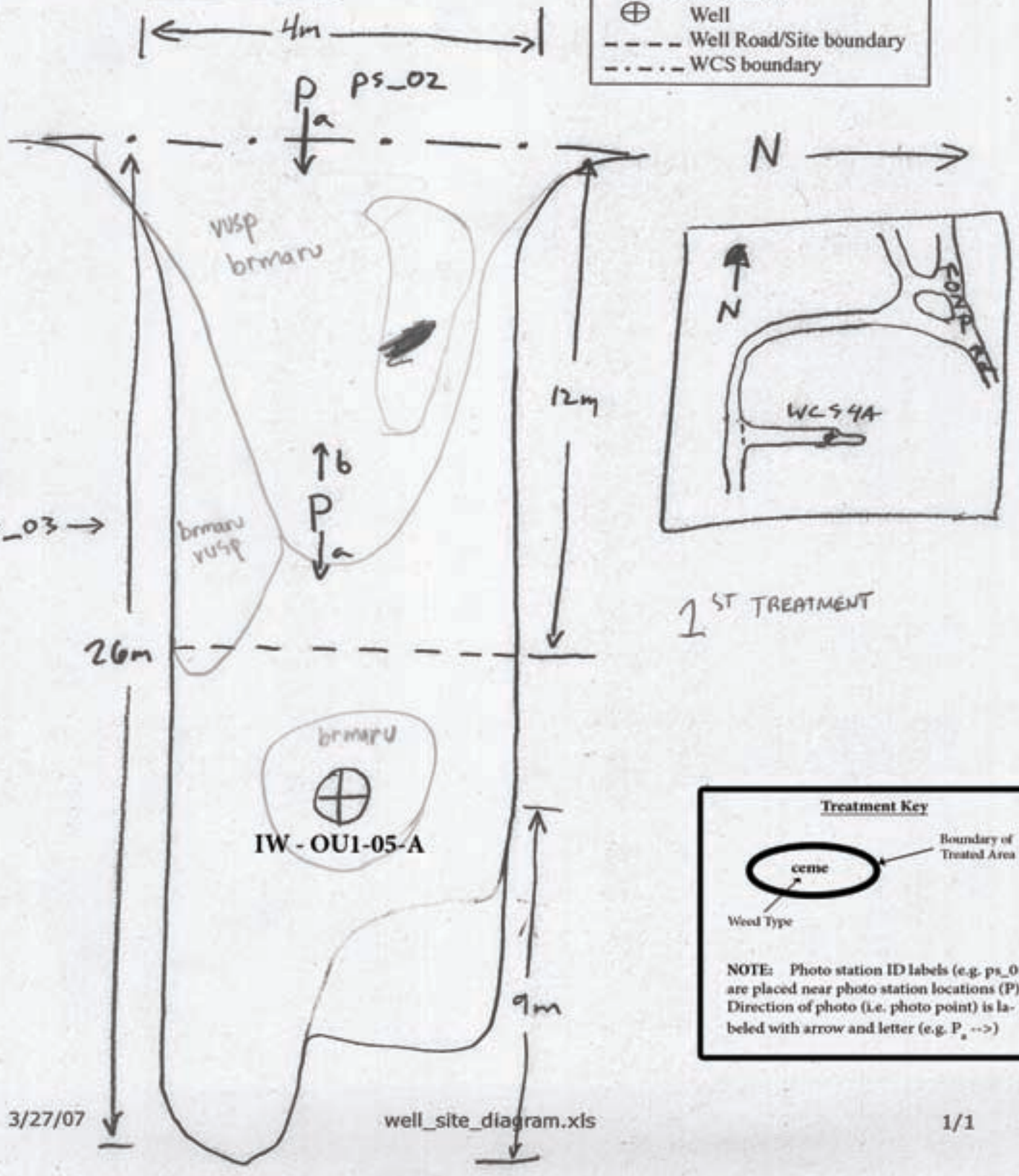
Total Aprox. Area 94 (m^2)

Well Rd. Area 48 (m^2)

Well Site Area 46m (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-01-A

WCS Sub Group: 5-A

Total Aprox. Area: 240 (m^2)

Well Rd. Area: 174 (m^2)

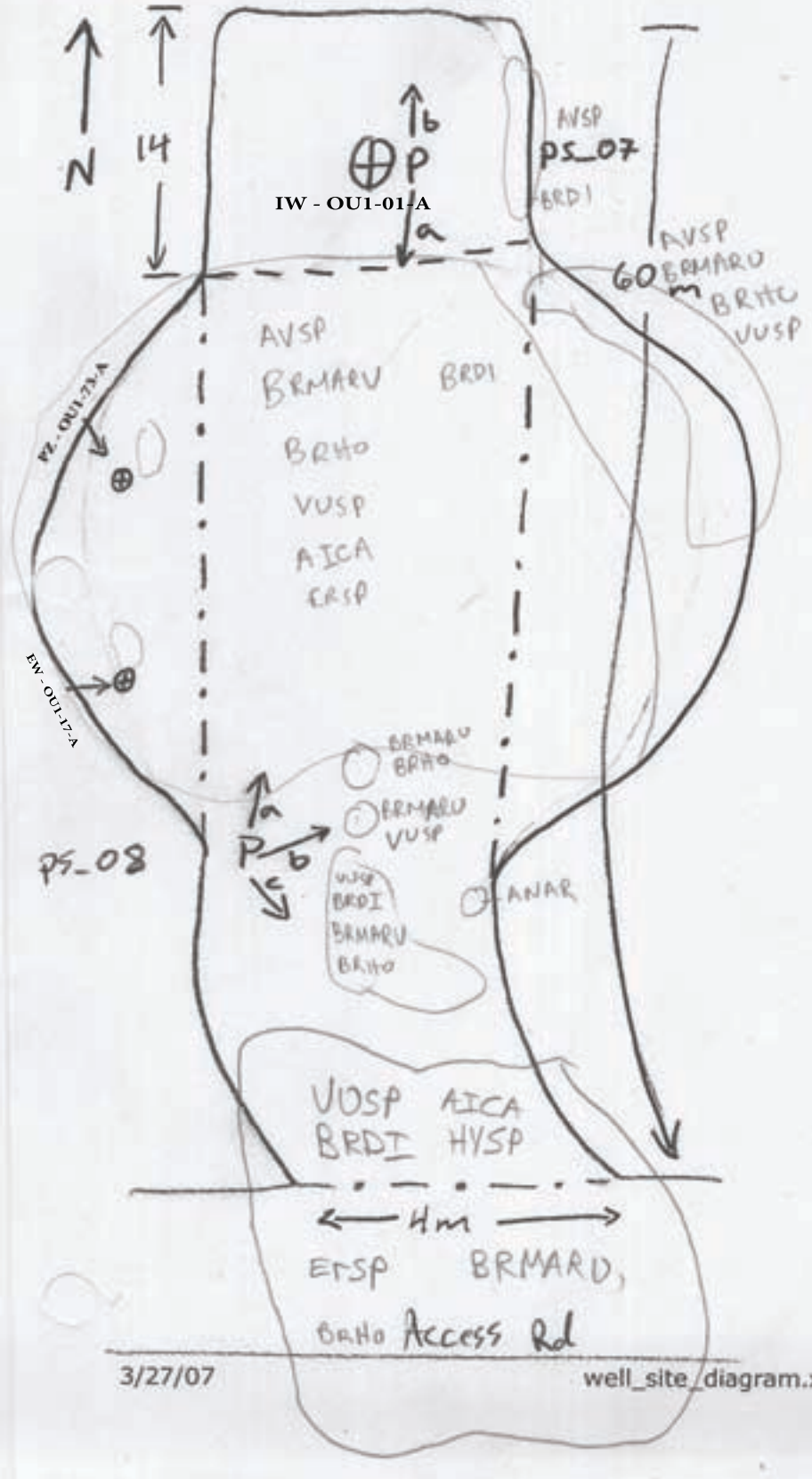
Well Site Area: 56 (m^2)

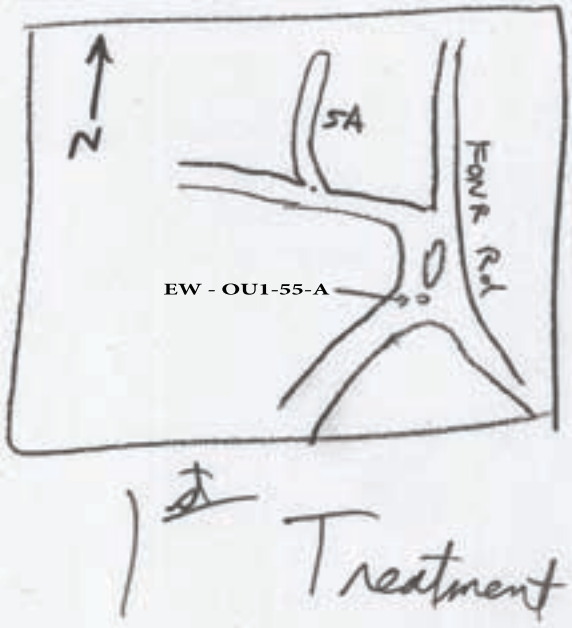
Date: 4-12-12

Surveyor: MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
-.-.-	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-01-A

WCS Sub Group 5-A

Total Aprox. Area 240 (m^2)

Well Rd. Area 174 (m^2)

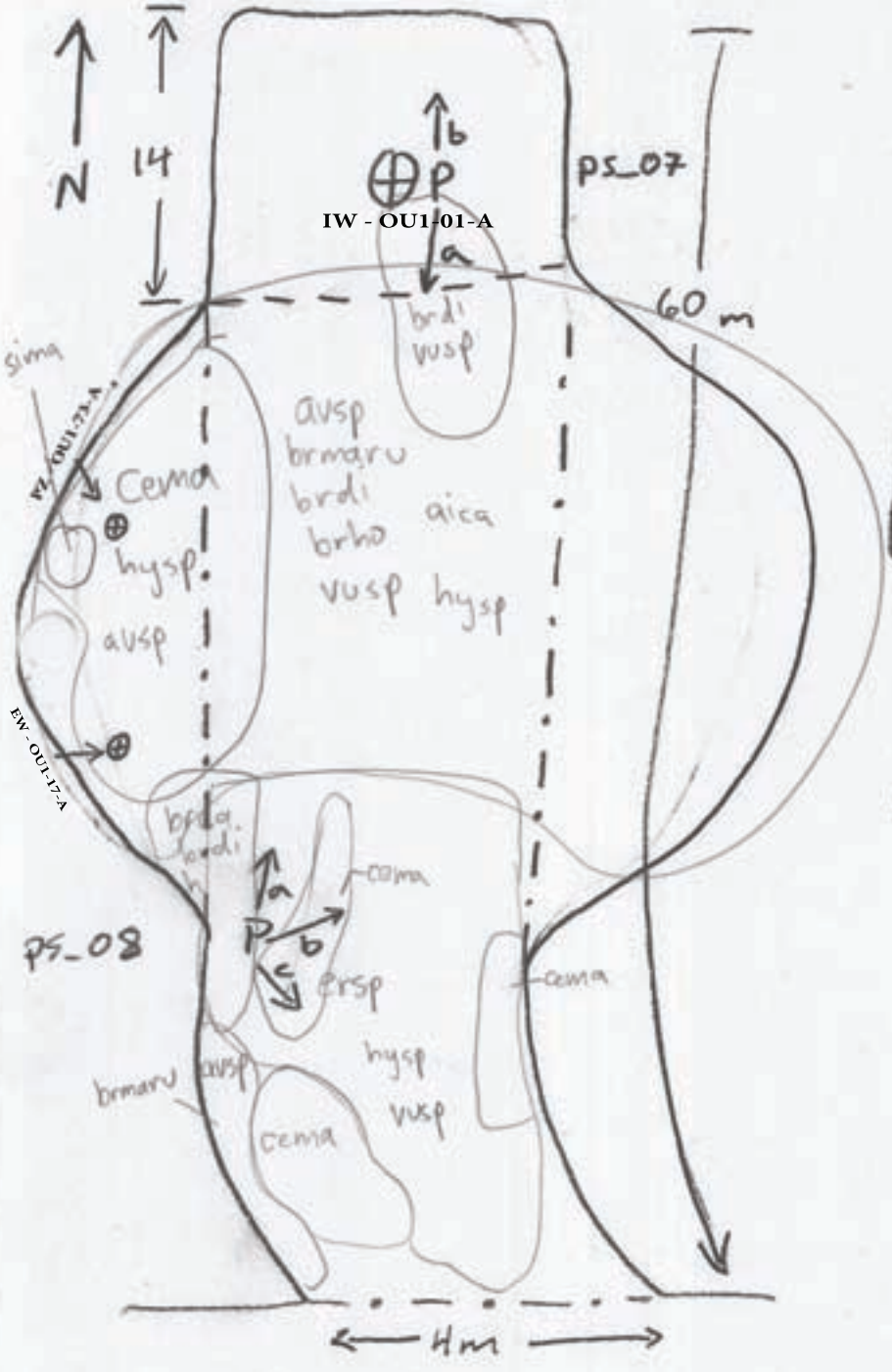
Well Site Area 56 (m^2)

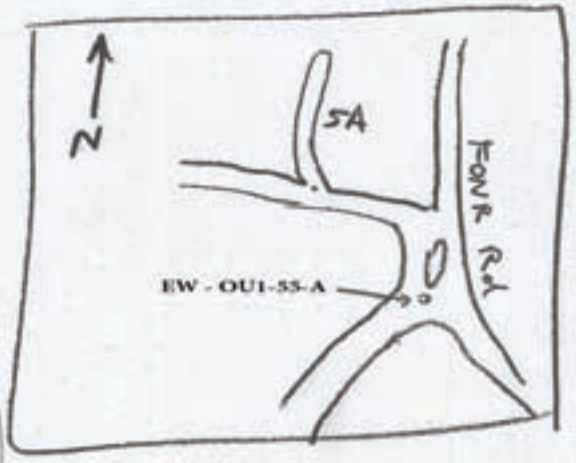
Date 5/30/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2ND TREATMENT

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Access Rd

Well ID: EW-OUI-53-A

Date 5-17-12

WCS Sub Group 6A

Surveyor MNB

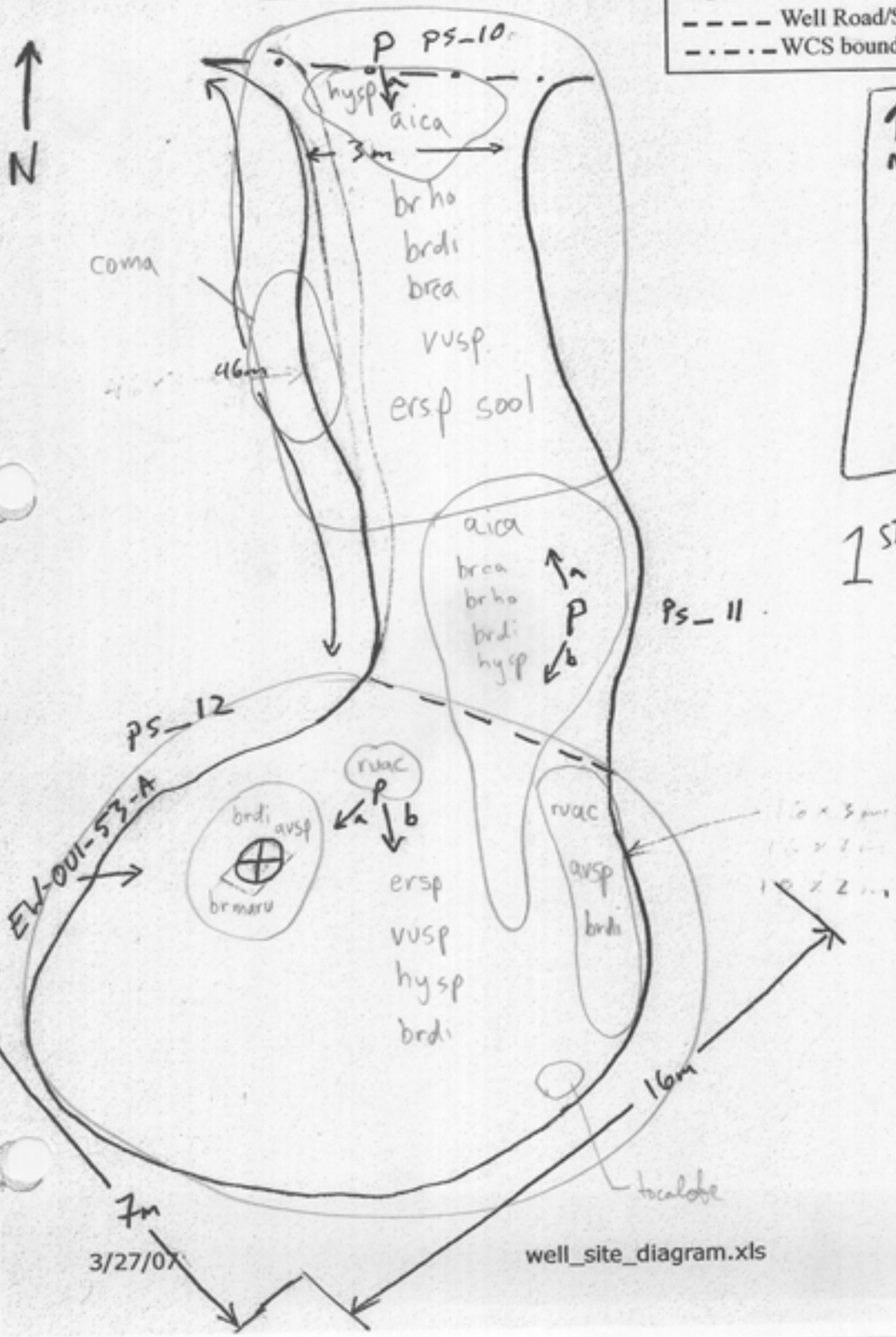
Total Aprox. Area 220 (m^2)

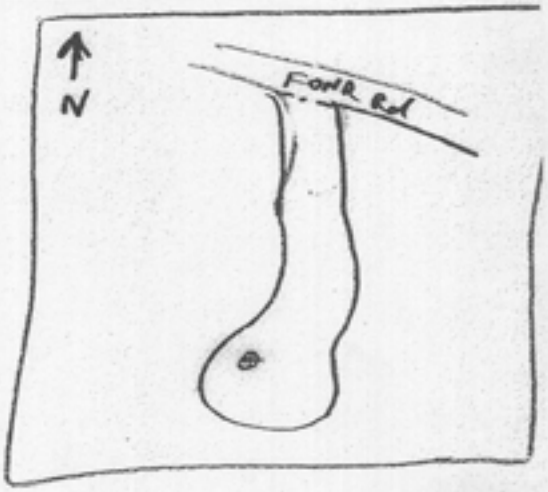
Well Rd. Area 138 (m^2)

Well Site Area 82 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1ST TREATMENT

Well ID: EW-OUI-53-A

Date 6/21/12

WCS Sub Group 6A

Surveyor MNB

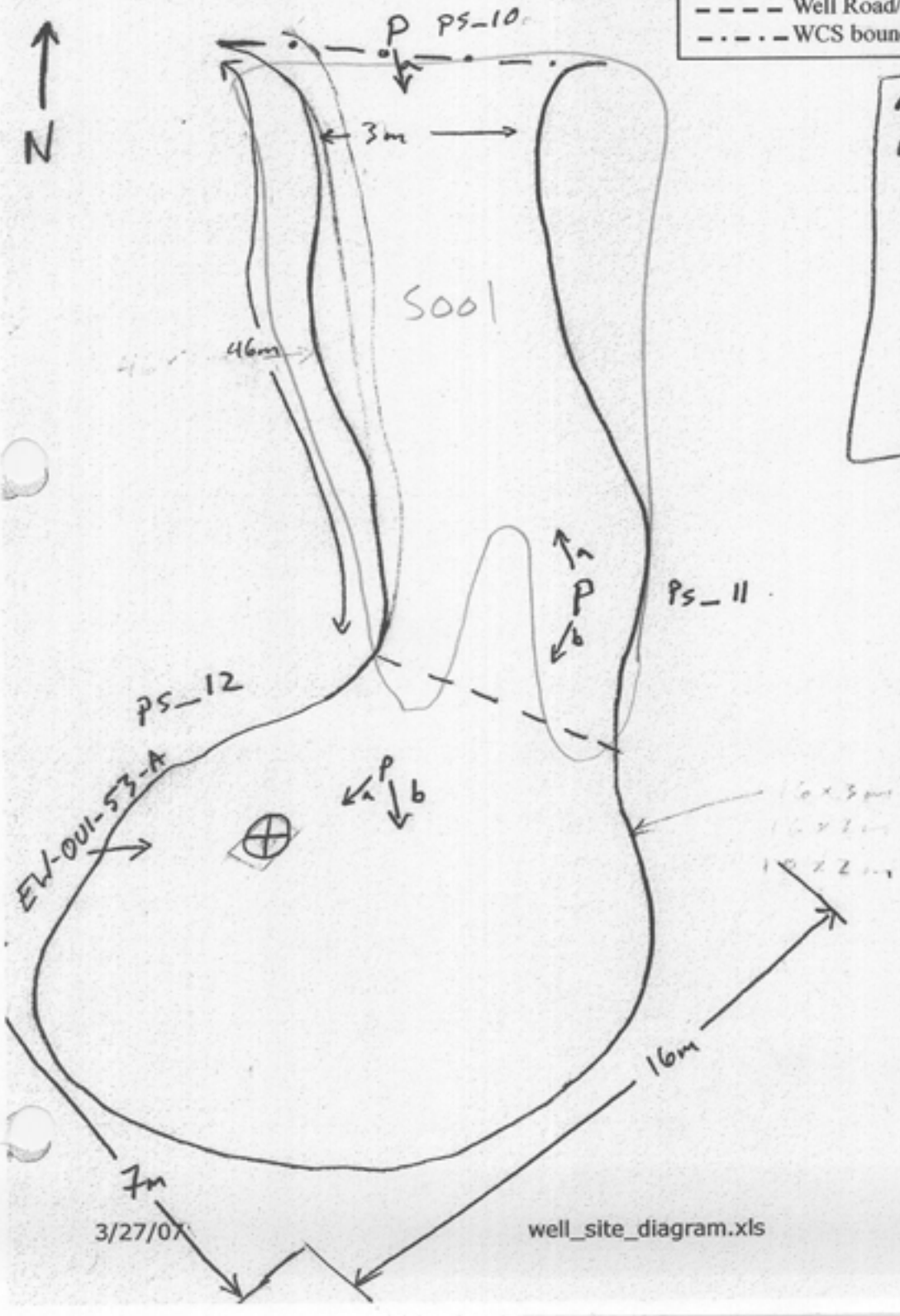
Total Aprox. Area 220 (m^2)

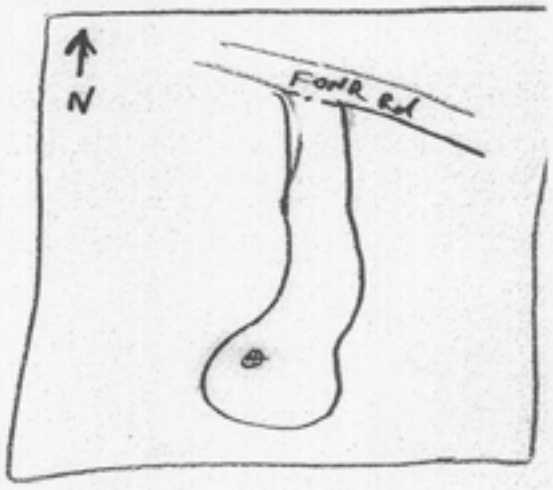
Well Rd. Area 138 (m^2)

Well Site Area 82 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2ND TREATMENT

Well ID: EW-OU1-52A

Date 5/17/12

WCS Sub Group 7A

Surveyor MNB

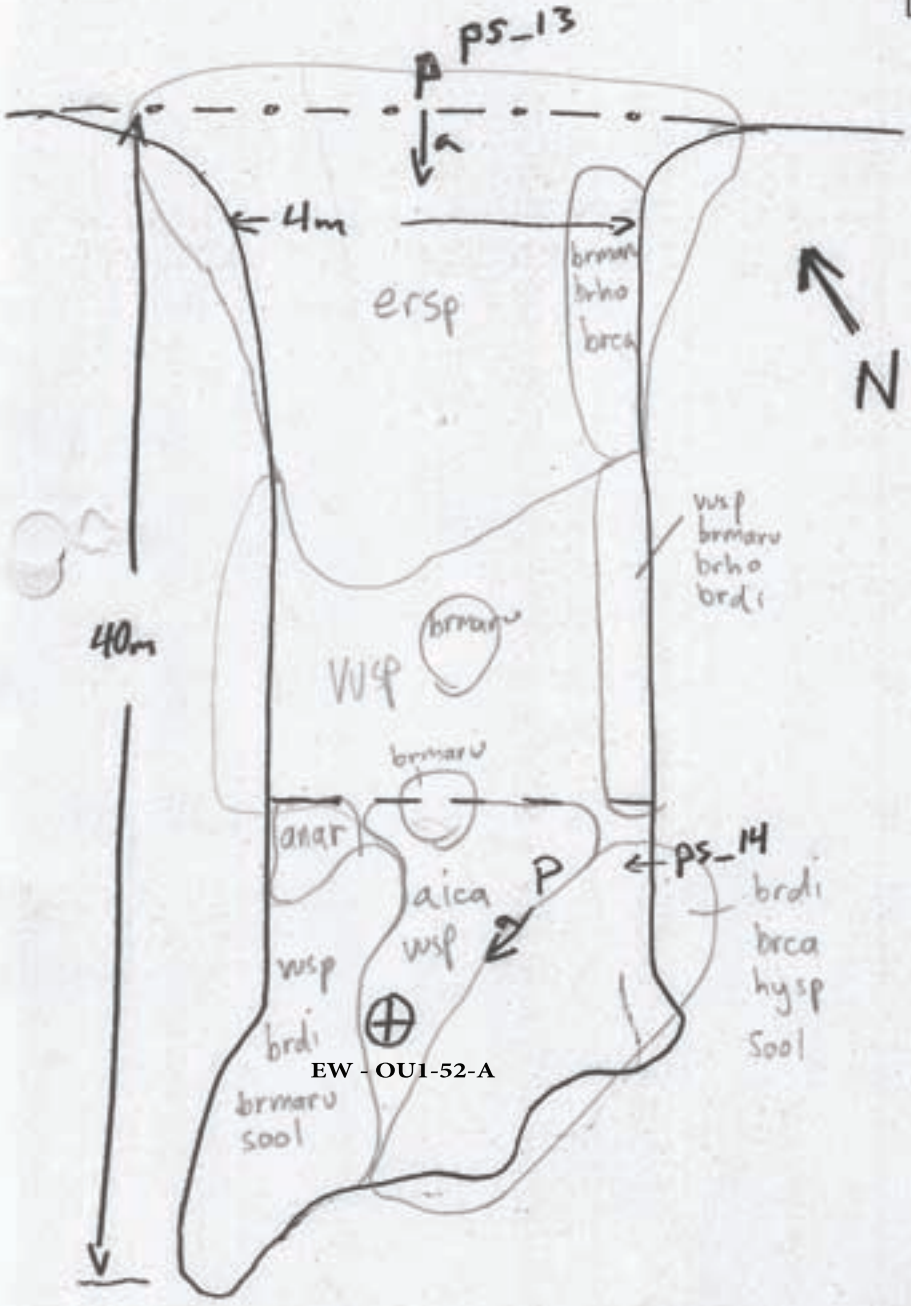
Approx. Area 164 (m²)

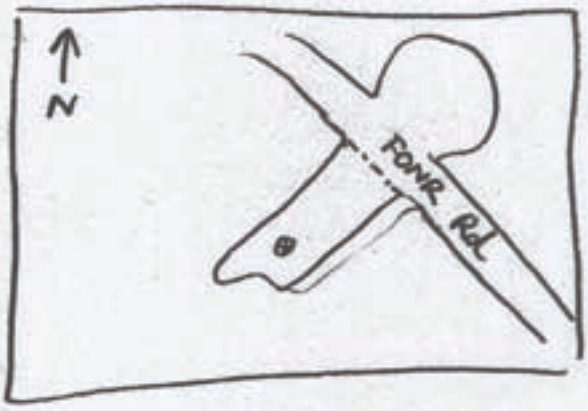
Well Rd. Area 120 (m²)

Well Site Area 44 (m²)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
-.-.-	WCS boundary





1st TREATMENT

EW - OU1-52-A

Well ID: PZ-OU1-10-A1 / IW-OU1-10-A

WCS Sub Group: 8A

Total Aprox. Area: 347 (m^2)

Well Rd. Area: 137 (m^2)

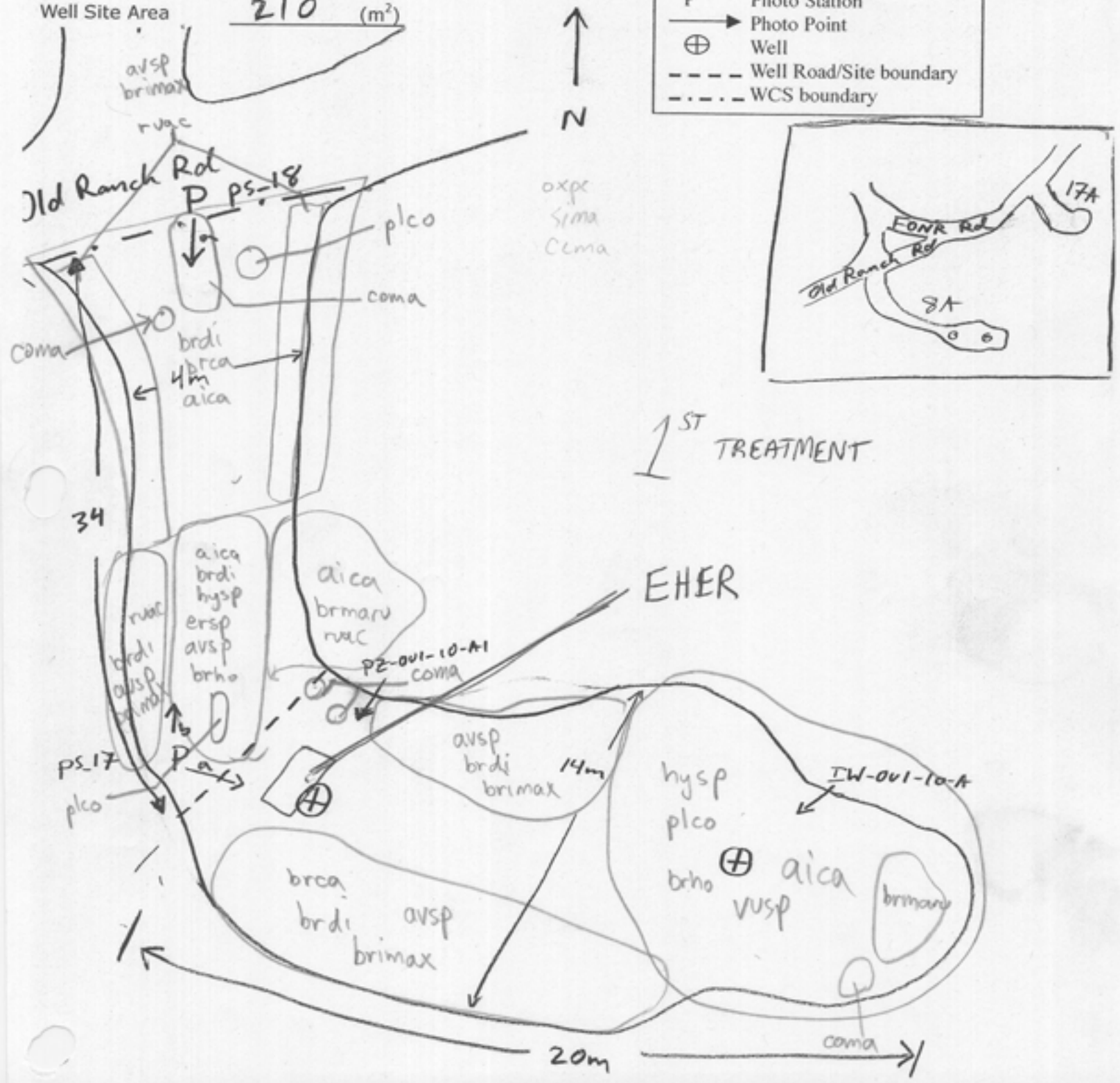
Well Site Area: 210 (m^2)

Date: 5/17/12

Surveyor: MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Well ID: PZ-OU1-10-A1
IW-OU1-10-A

WCS Sub Group 8A

Date 6/21/12

Surveyor MNB

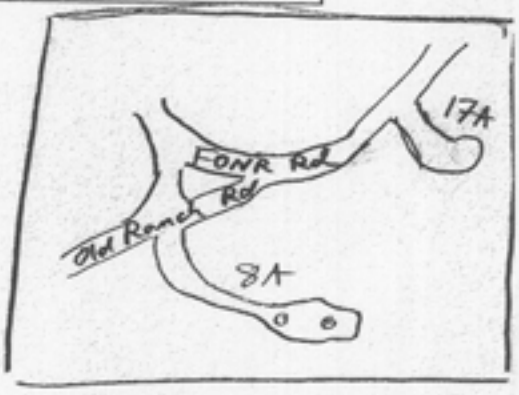
tal Aprox. Area 347 (m^2)

ell Rd. Area 137 (m^2)

Well Site Area 210 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



2ND TREATMENT

Well ID: MW-OU1-46AD / PZ-OU1-46-AD2, MW-OU1-46-A#

Date 4-19-12

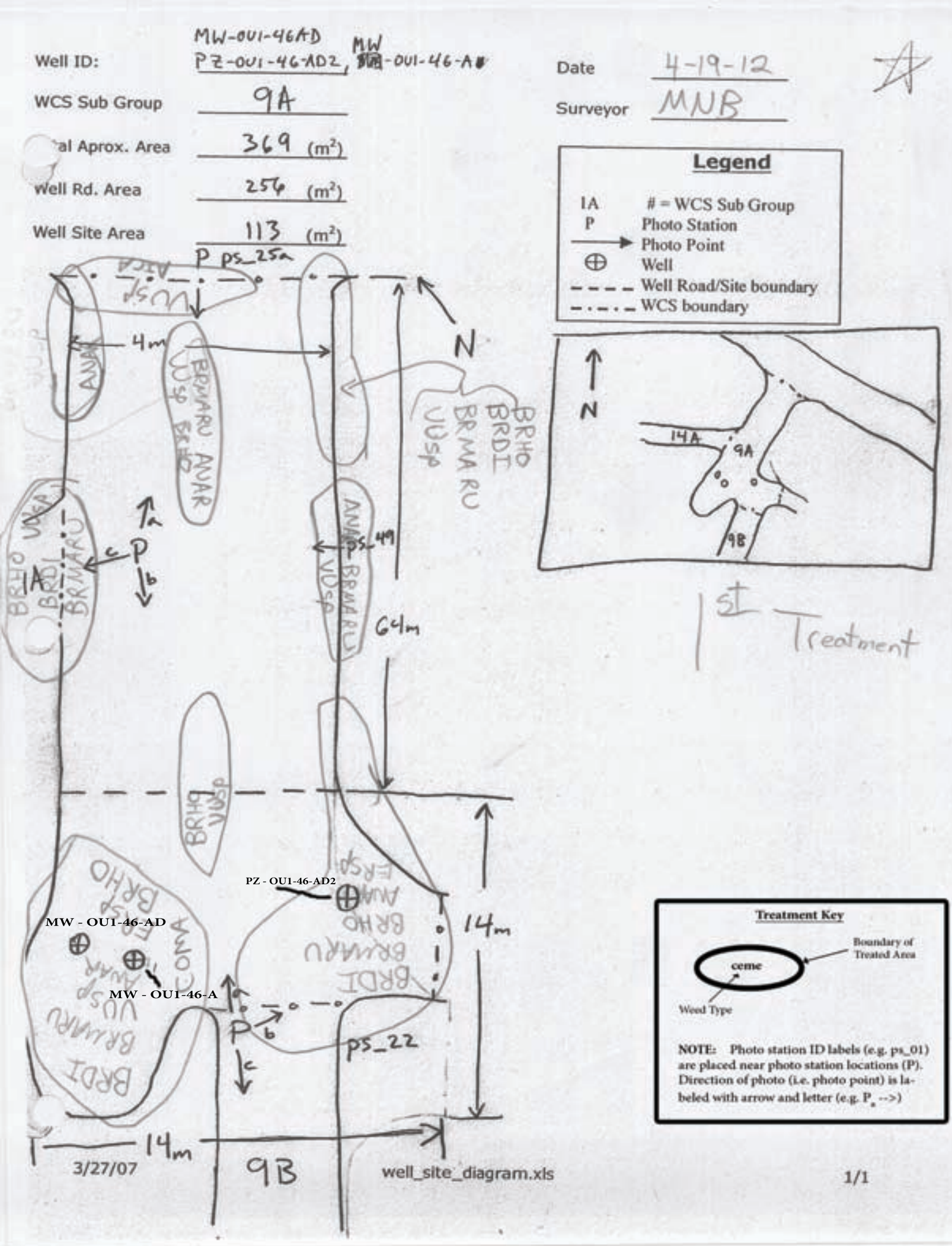
WCS Sub Group 9A

Surveyor MNB

al Aprox. Area 369 (m²)

Well Rd. Area 256 (m²)

Well Site Area 113 (m²)



Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P$_a$ -->)

Well ID: MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A#

Date 5/30/12

WCS Sub Group 9A

Surveyor MNB

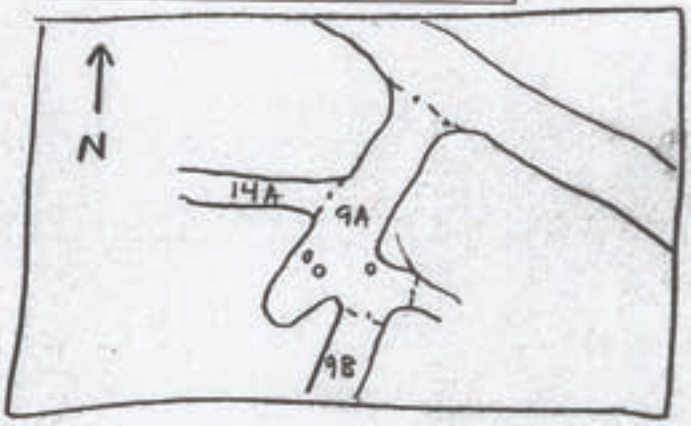
Total Aprox. Area 369 (m^2)

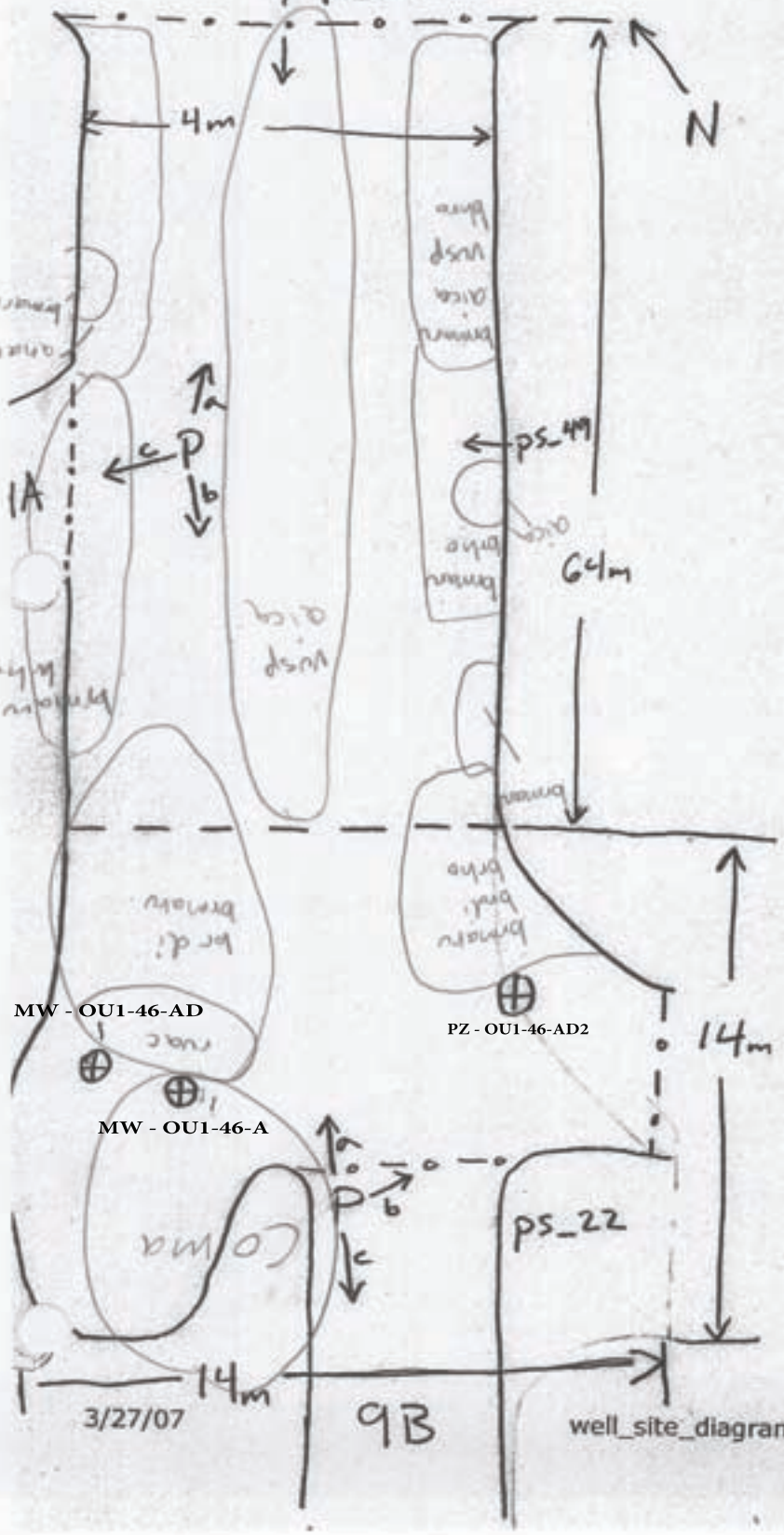
Well Rd. Area 256 (m^2)

Well Site Area 113 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

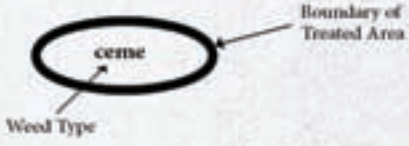




2ND TREATMENT

- alca
- anar
- brmaru
- brdi
- brho
- coma
- rvac
- vusp

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-84A

WCS Sub Group 9B

Date 4-25-12

Surveyor MNB

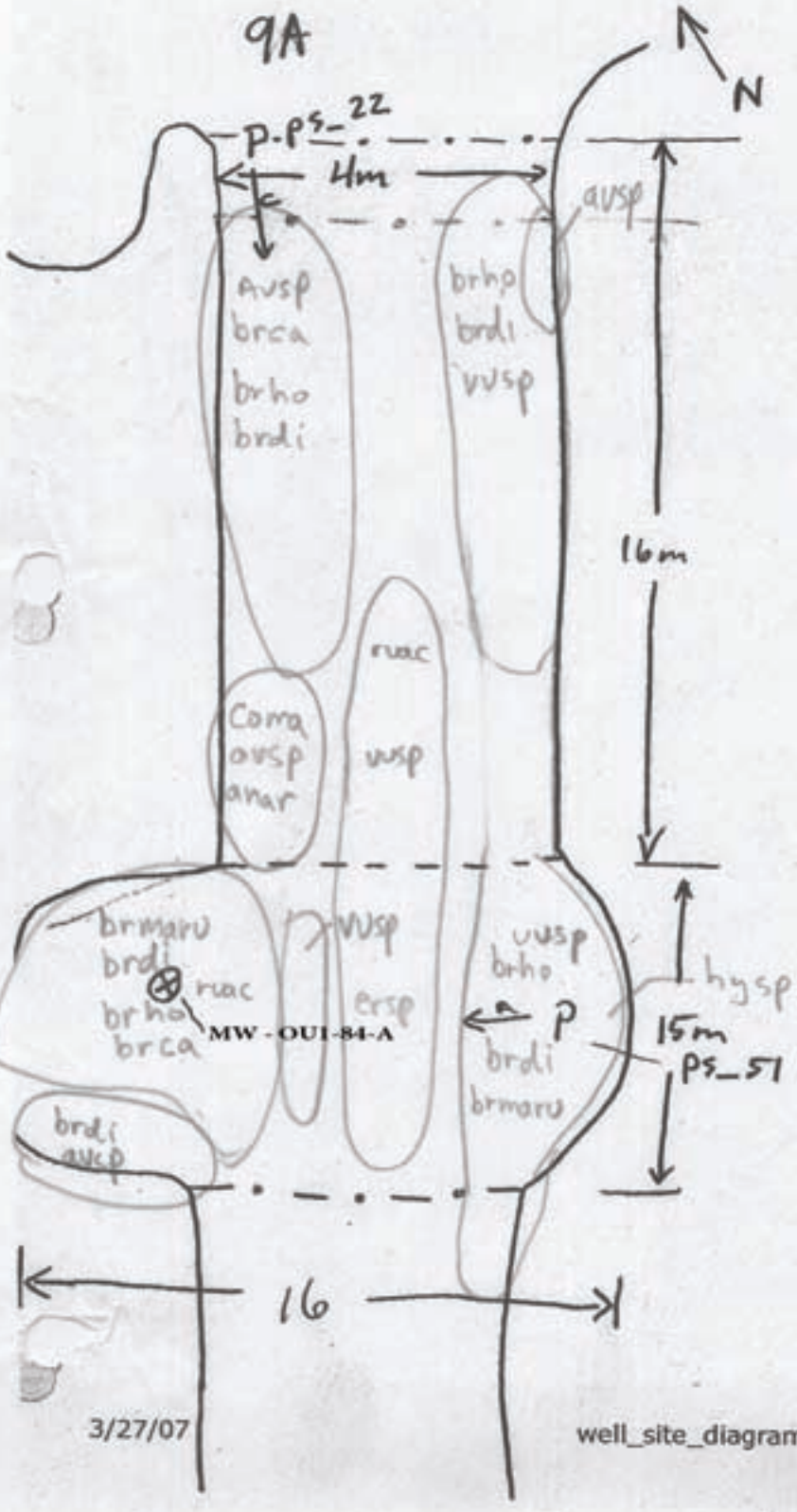
al Aprox. Area 304 (m^2)

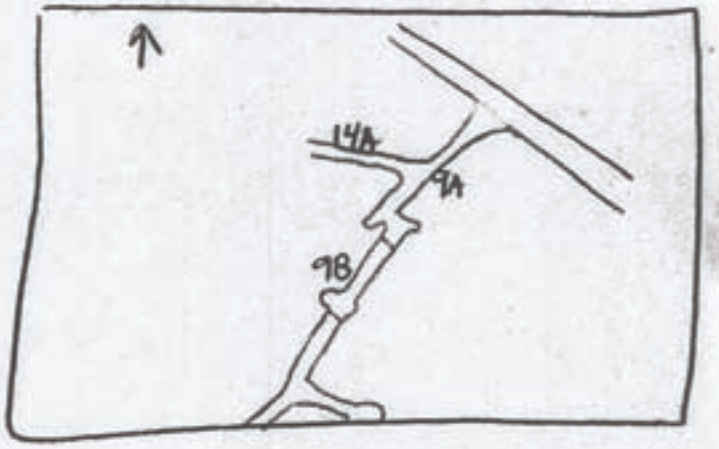
ell Rd. Area 64 (m^2)

Well Site Area 240 (m^2)

Legend

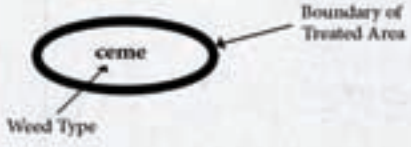
1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1ST TREATMENT

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-84A

WCS Sub Group 9B

Total Aprox. Area 304 (m^2)

Well Rd. Area 64 (m^2)

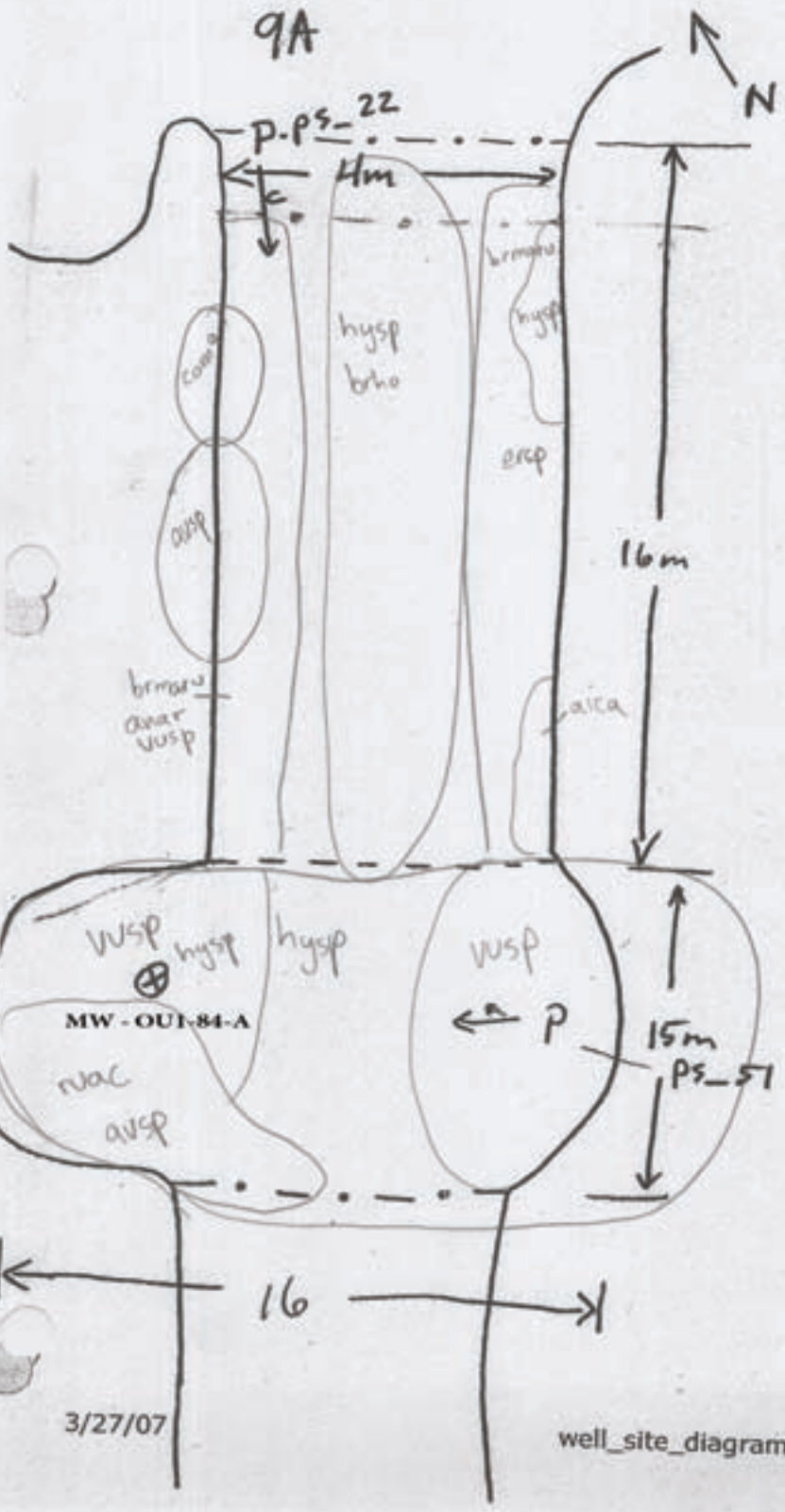
Well Site Area 240 (m^2)

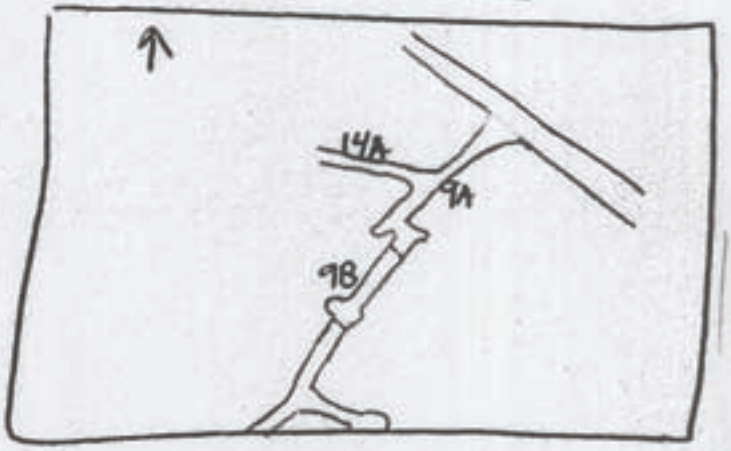
Date 5/30/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
-·-·-	WCS boundary

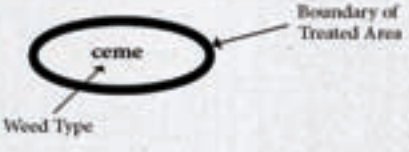




2ND TREATMENT

- bromaru
- brho
- ausp
- cema
- aica
- hysp
- vusp
- rvac
- anar

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

well_site_diagram.xls

Well ID: MW-OU1-84A

WCS Sub Group 9B

Total Aprox. Area 304 (m^2)

Well Rd. Area 64 (m^2)

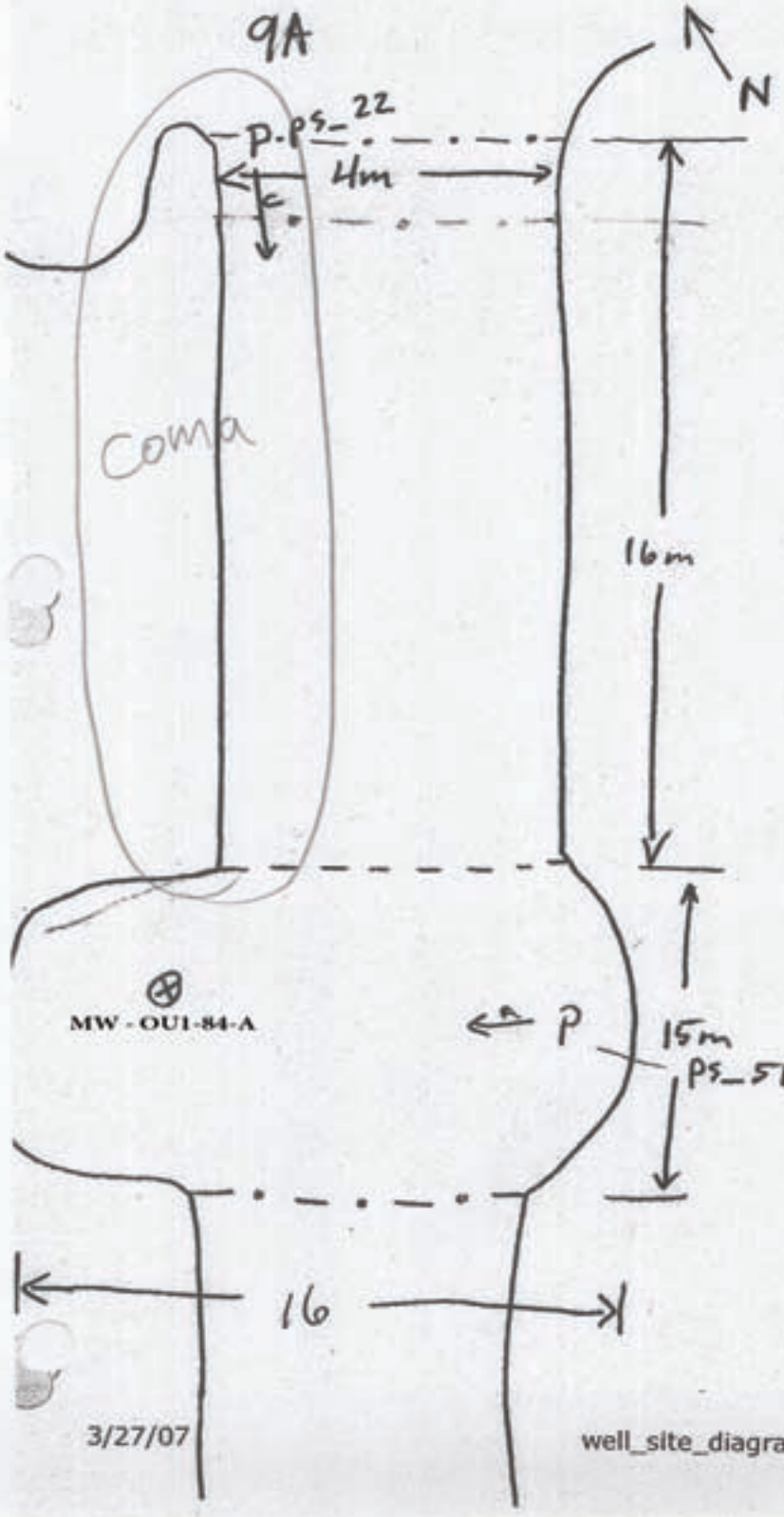
Well Site Area 240 (m^2)

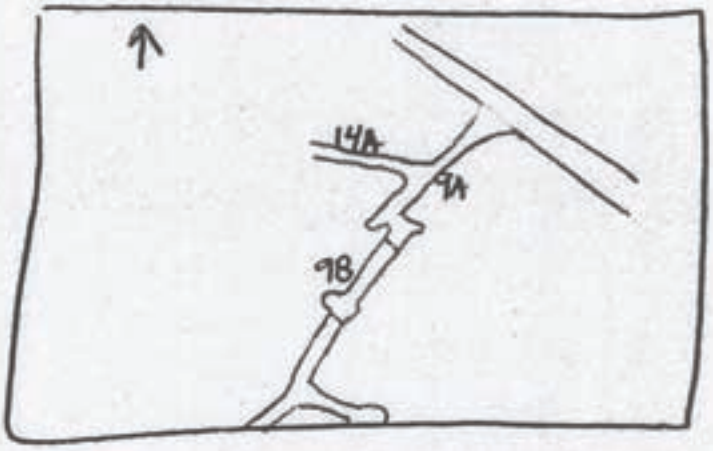
Date 6/21/12

Surveyor MNB

Legend

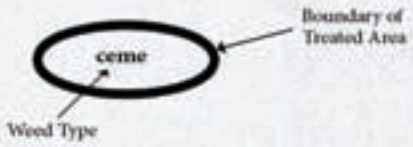
1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





3RD TREATMENT

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-74A

WCS Sub Group 9C

tal Aprox. Area 198 (m²)

Well Rd. Area 144 (m²)

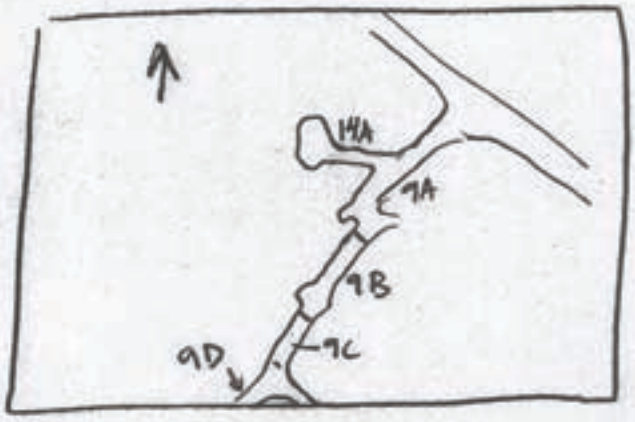
Well Site Area 54 (m²)

Date 4-25-12

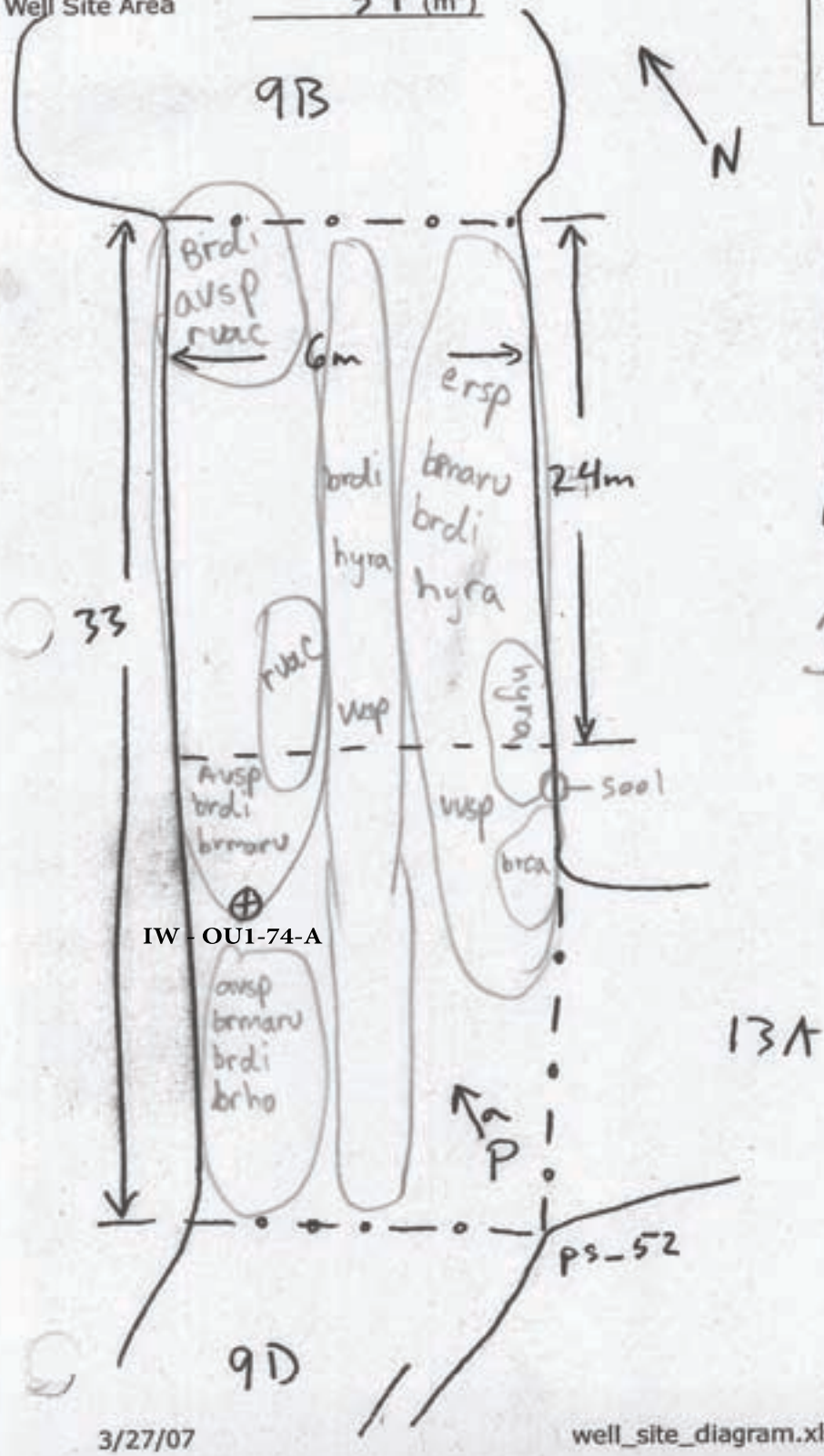
Surveyor MNB

Legend

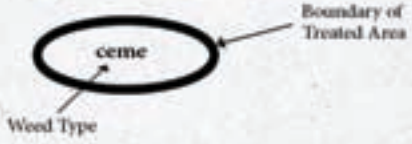
IA	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



1ST TREATMENT



Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P$_a$ -->)

Well ID: IW-OU1-74A

WCS Sub Group 9C

tal Aprox. Area 198 (m^2)

vell Rd. Area 144 (m^2)

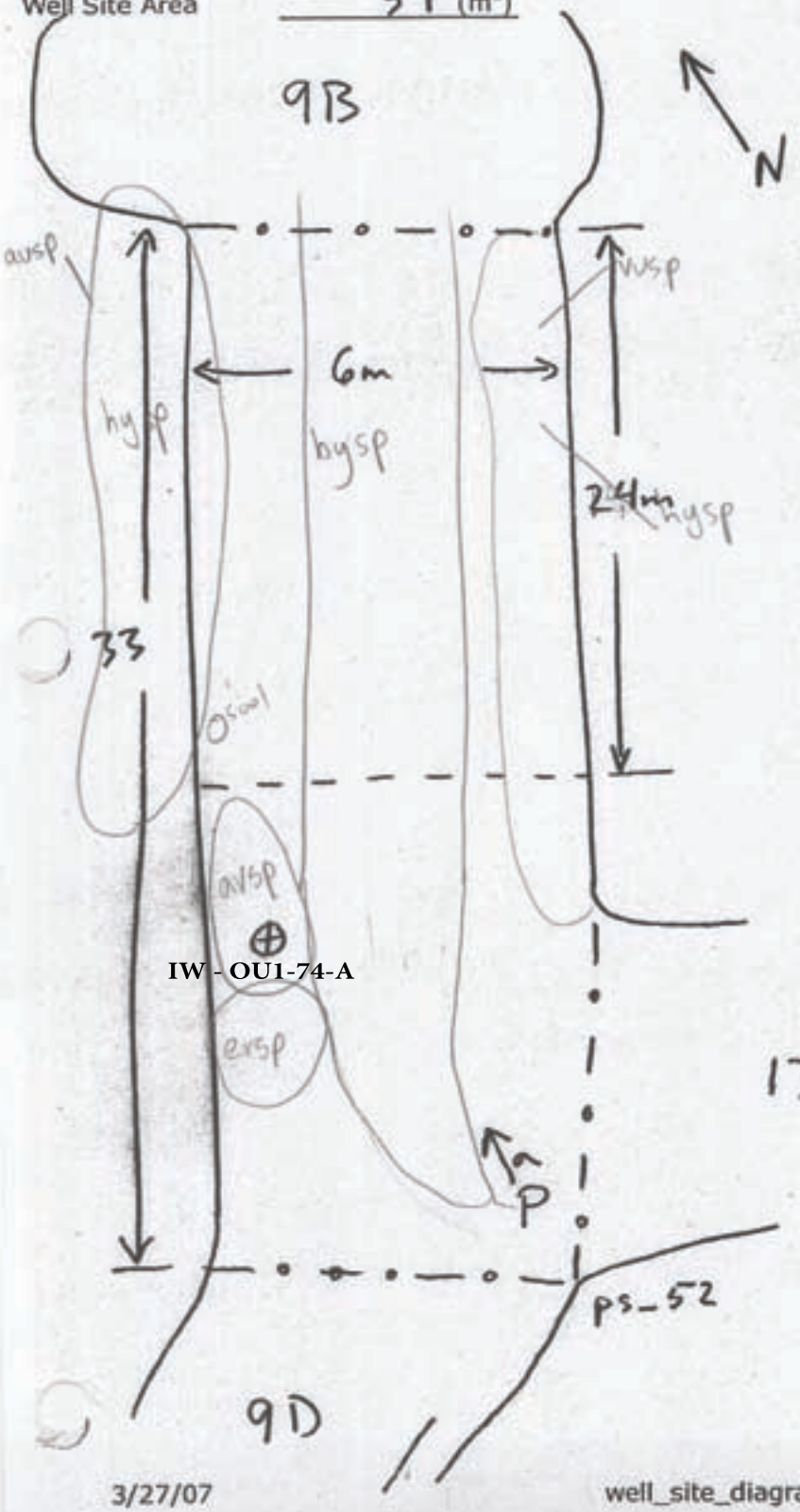
Well Site Area 54 (m^2)

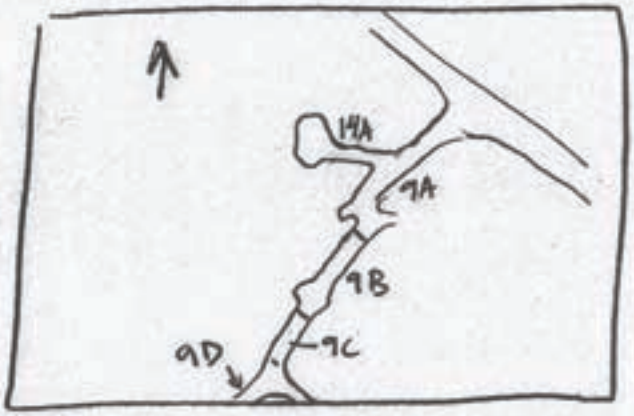
Date 5/30/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
-.-.-	WCS boundary





2ND TREATMENT

- ausp
- ersp
- sool
- hysp
- vusp

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-51A

WCS Sub Group 9D

Total Aprox. Area 160 (m^2)

Well Rd. Area 104 (m^2)

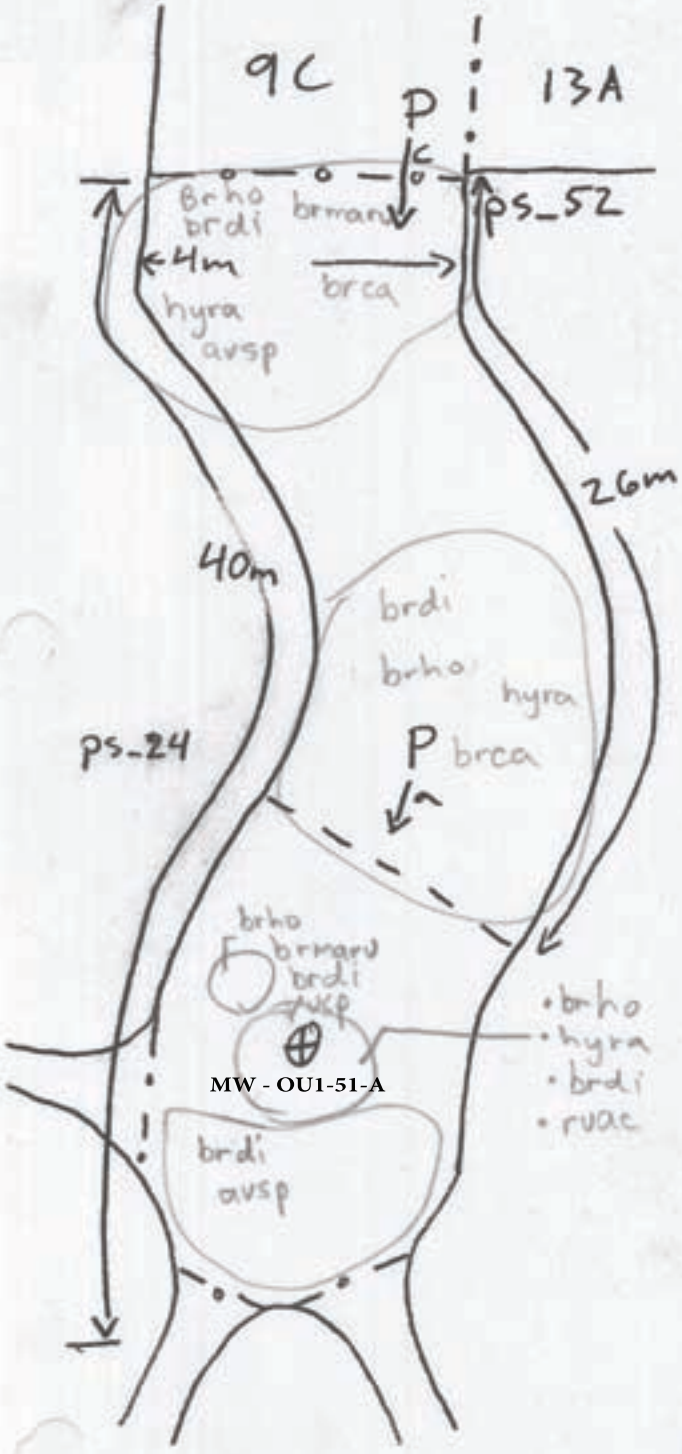
Well Site Area 56 (m^2)

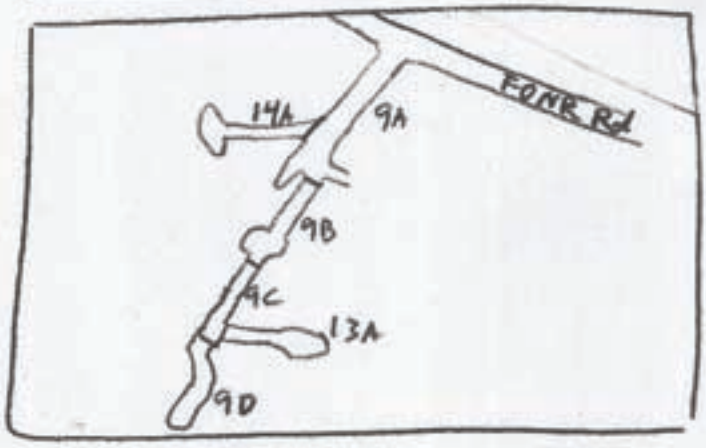
Date 4-25-12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1ST TREATMENT

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-51A

WCS Sub Group 9D

Date 5/30/12

Surveyor MNB

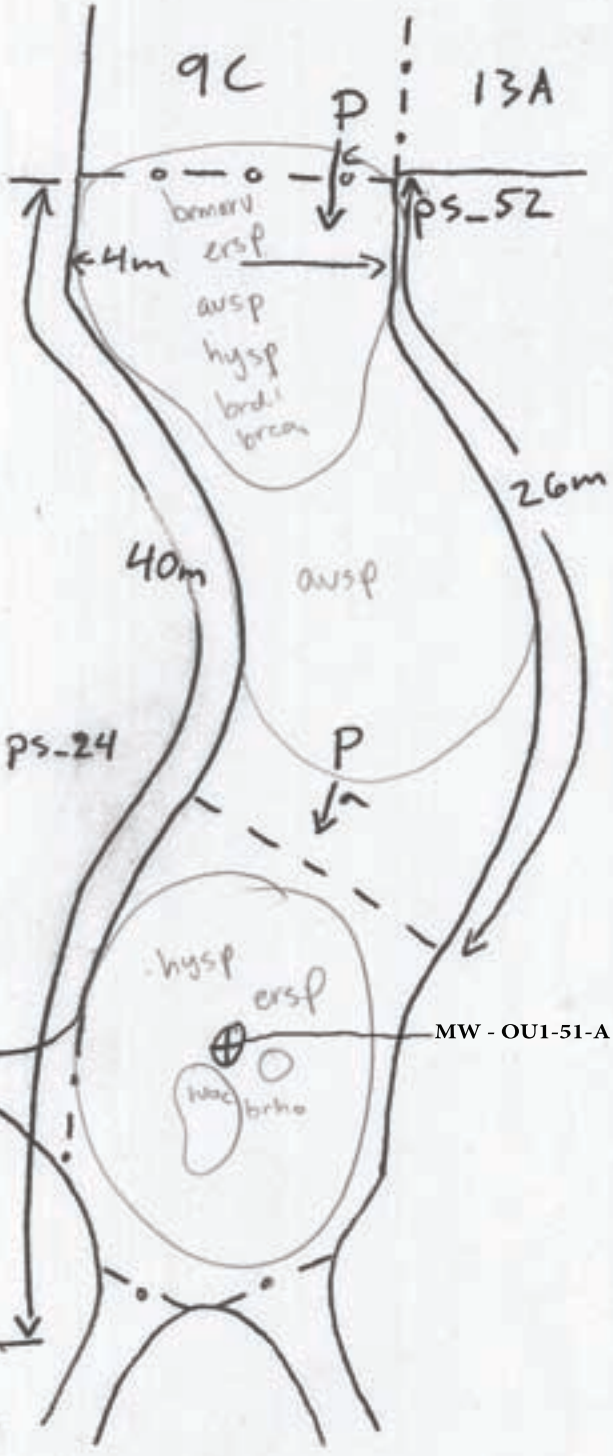
Total Aprox. Area 160 (m^2)

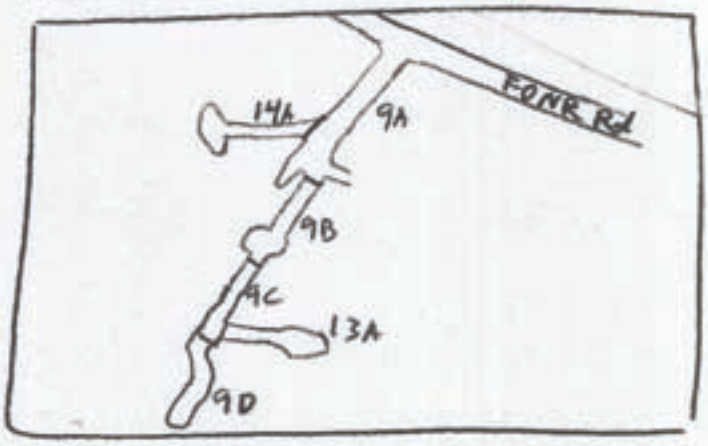
Well Rd. Area 104 (m^2)

Well Site Area 56 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2ND TREATMENT

- bnmarv
- ersp
- hysp
- ausp
- brdi
- brca
- brho
- rvac

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-50A

Date 4/26/12

WCS Sub Group 10A

Surveyor MNB

Total Aprox. Area 120 (m^2)

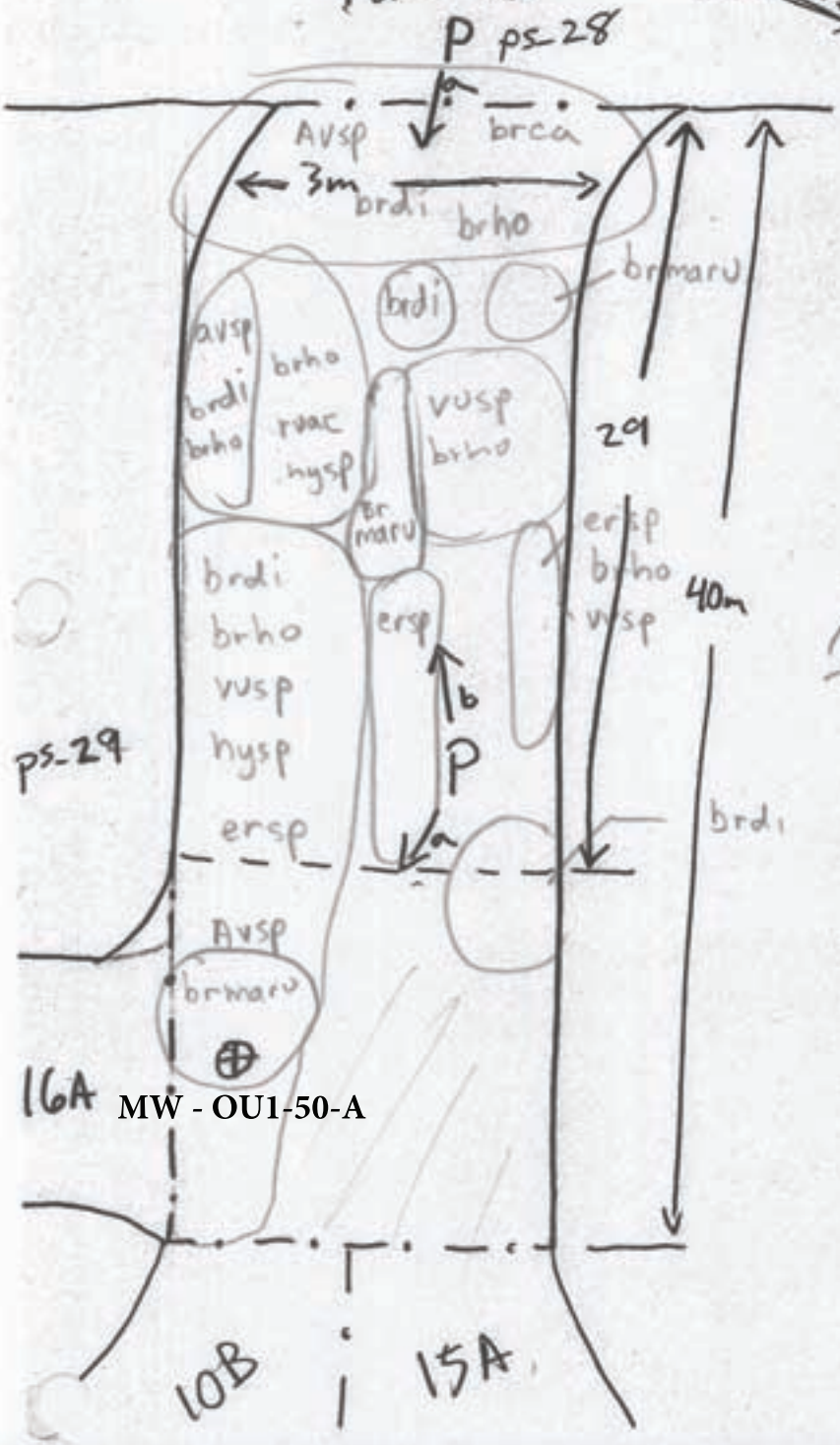
Well Rd. Area 87 (m^2)

Well Site Area 33 (m^2)

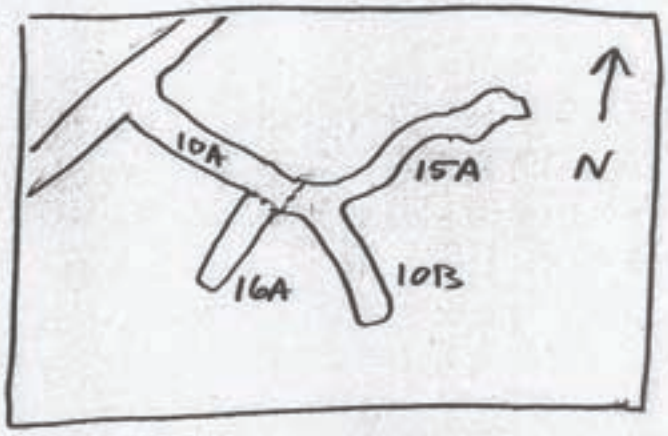
FONR Rd

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

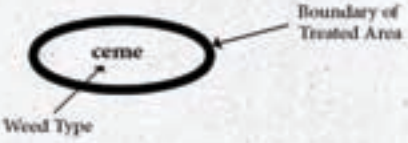


1ST TREATMENT



MW - OU1-50-A

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-59A

Date 4-26-12

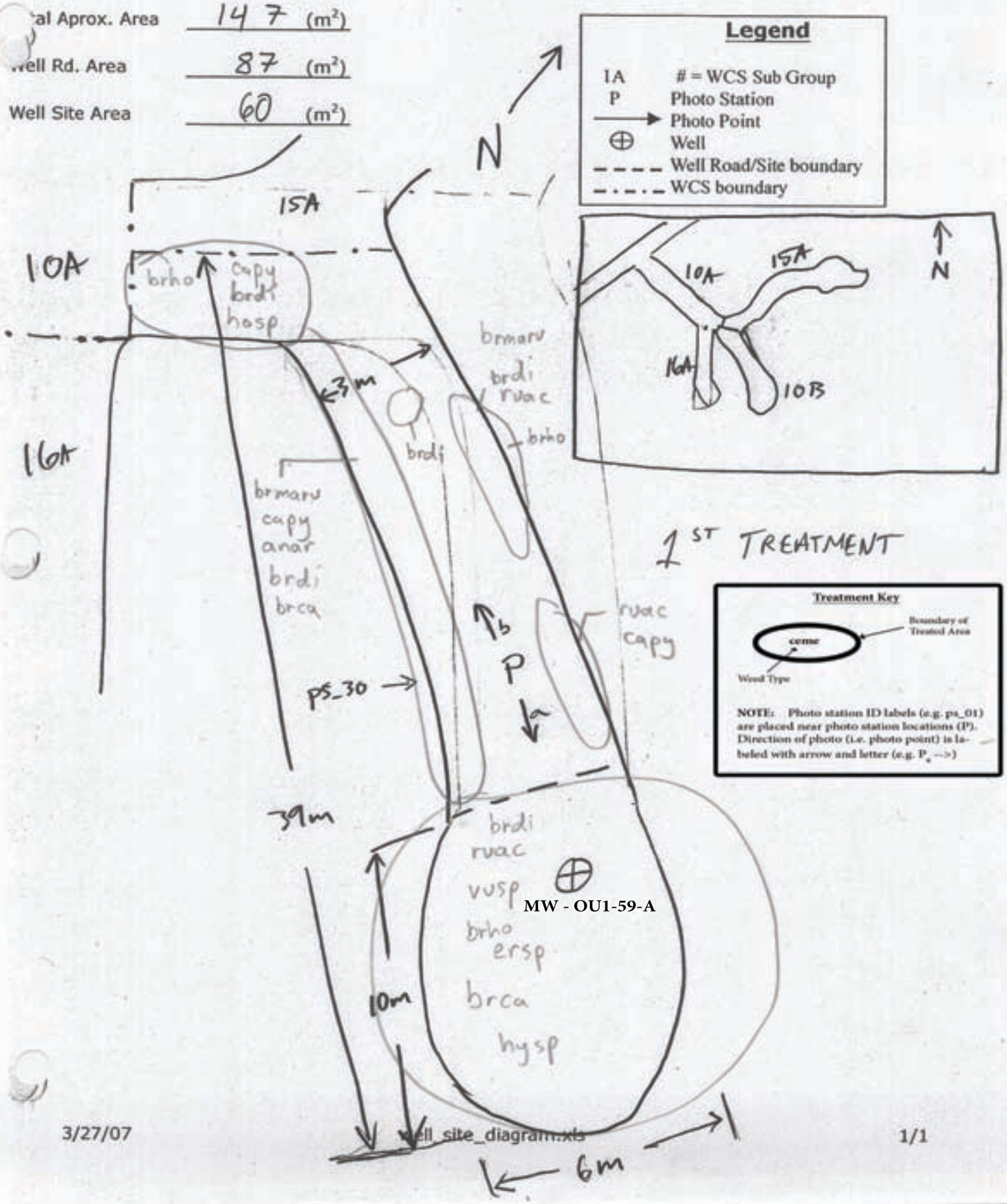
WCS Sub Group 10B

Surveyor MNB

Total Aprox. Area 147 (m²)

Well Rd. Area 87 (m²)

Well Site Area 60 (m²)



MW - OU1-59-A

Well ID: EW-OU1-71A

WCS Sub Group: 11A

Date: 5/24/12

Surveyor: MNB

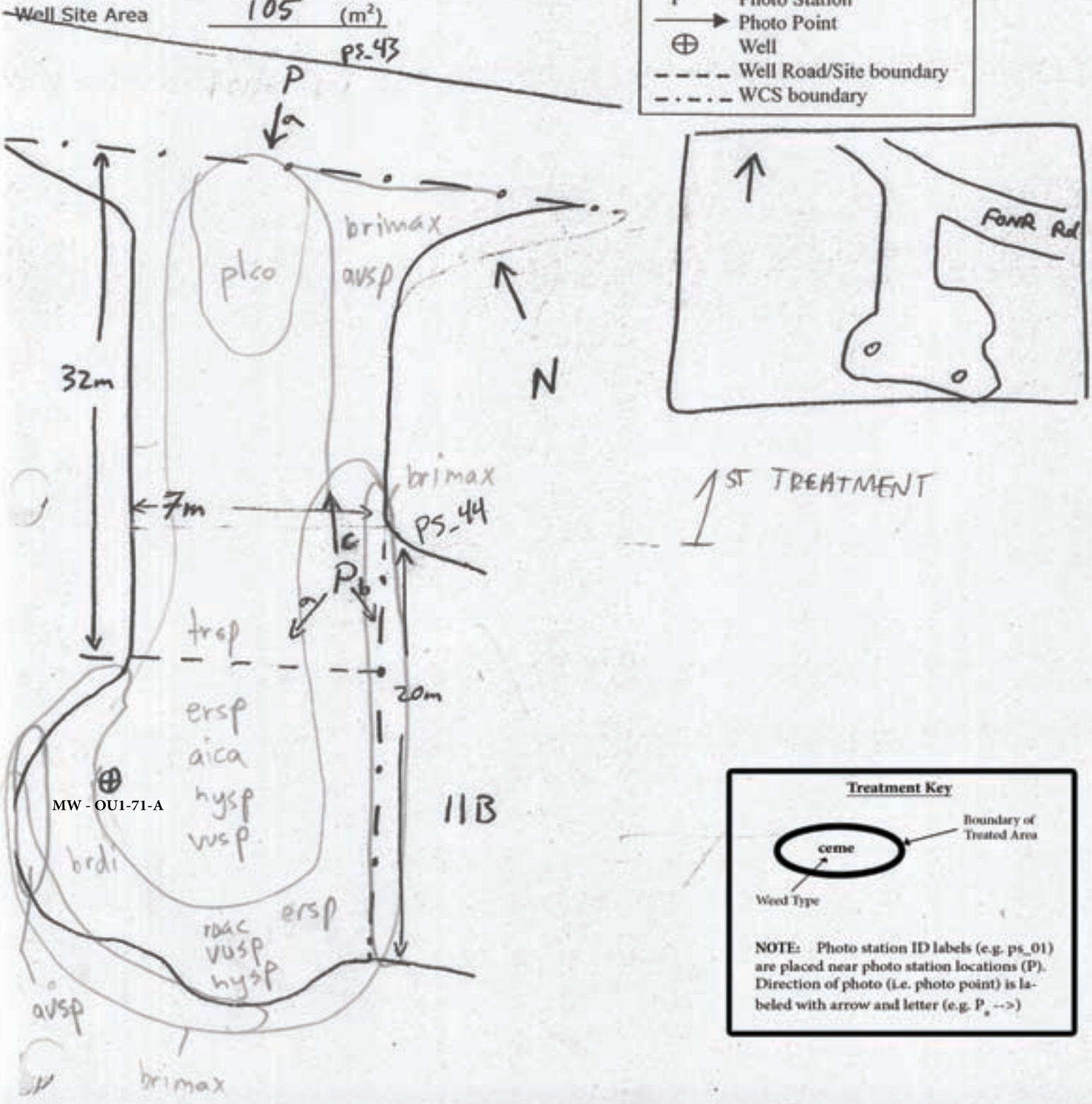
al Aprox. Area: 329 (m^2)

ell Rd. Area: 224 (m^2)

Well Site Area: 105 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-86A

WCS Sub Group 11B

Total Aprox. Area 390 (m²)

Well Rd. Area N/A (m²)

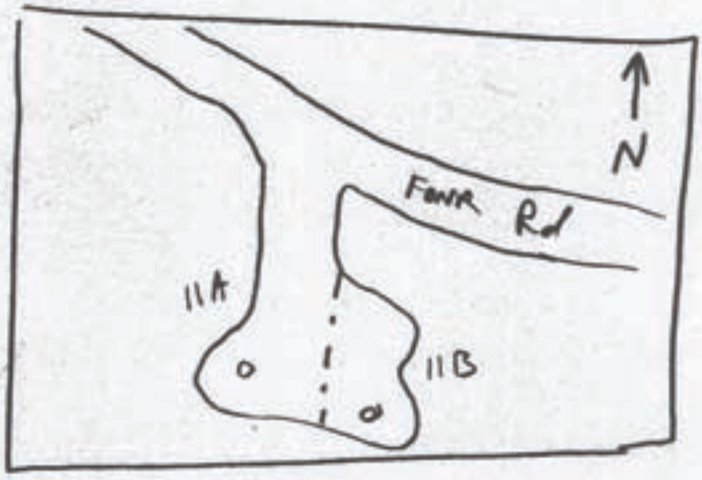
Well Site Area 390 (m²)

Date 5/24/12

Surveyor MNB

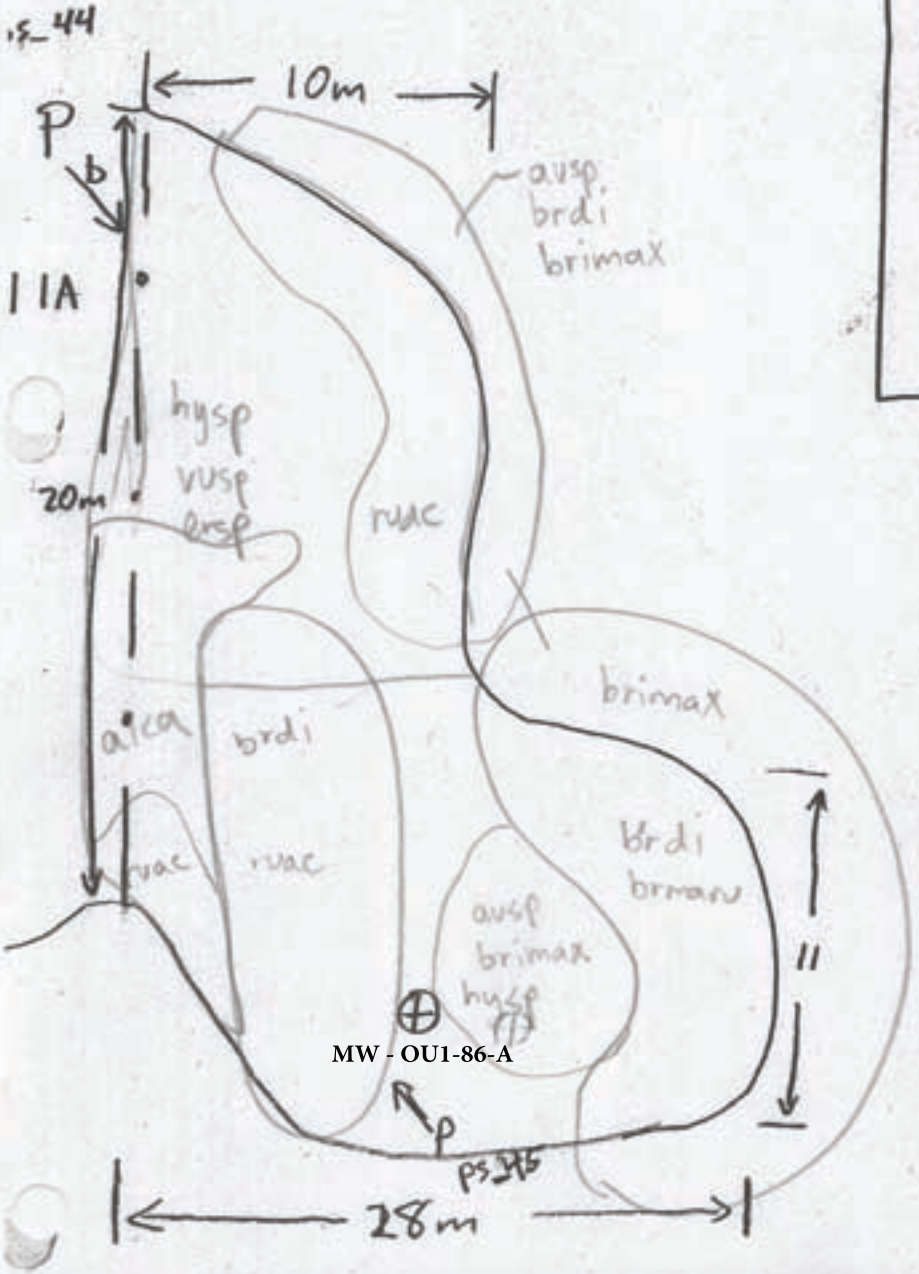
Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

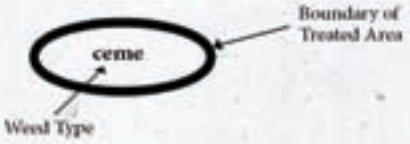


RARE PLANT SURVEY (N.A)

1st TREATMENT



Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_e -->)

Well ID: EW-OU1-72A

Date 3/24/12

WCS Sub Group 12A

Surveyor MNB

tal Aprox. Area 148 (m^2)

ell Rd. Area 128 (m^2)

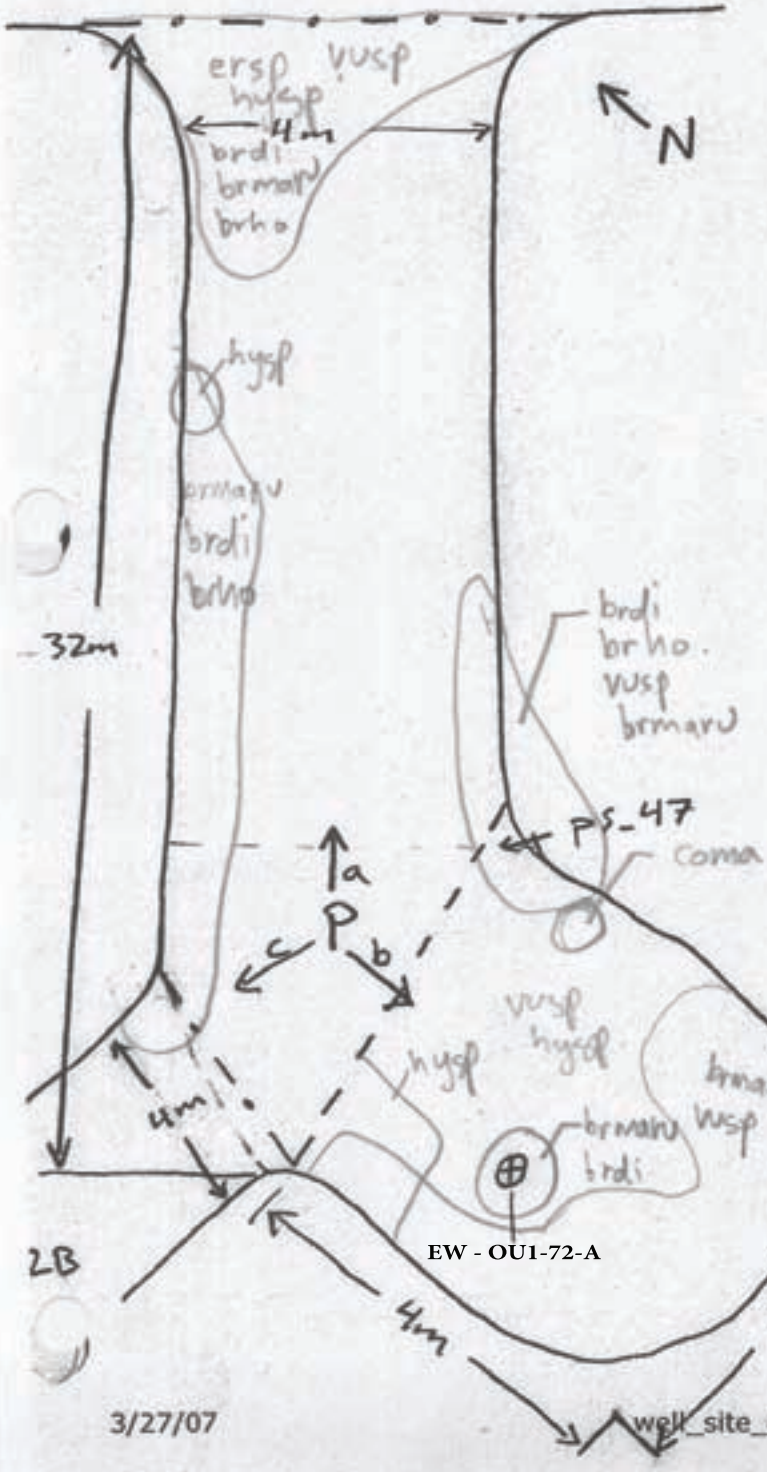
Well Site Area 20 (m^2)

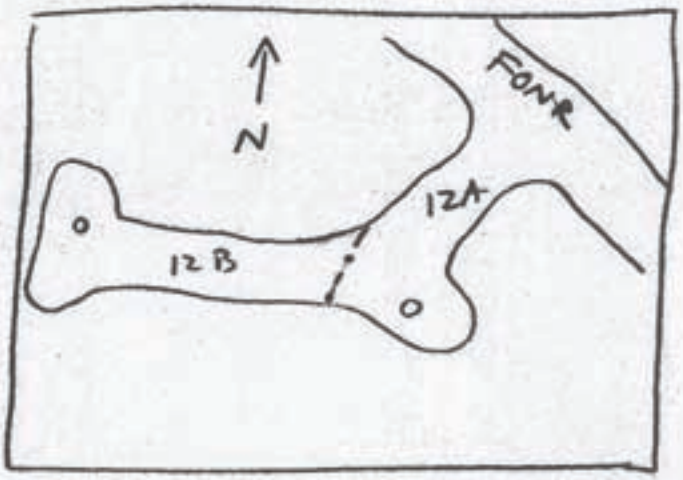
P ps_46

FONR RoC

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

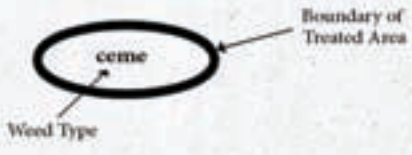




RARE PLANT SURVEY (N.A.)

1ST TREATMENT

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

EW - OU1-72-A

Well ID: MW-OU1-85-A

Date 5/24/12

WCS Sub Group 12B

Surveyor MNB

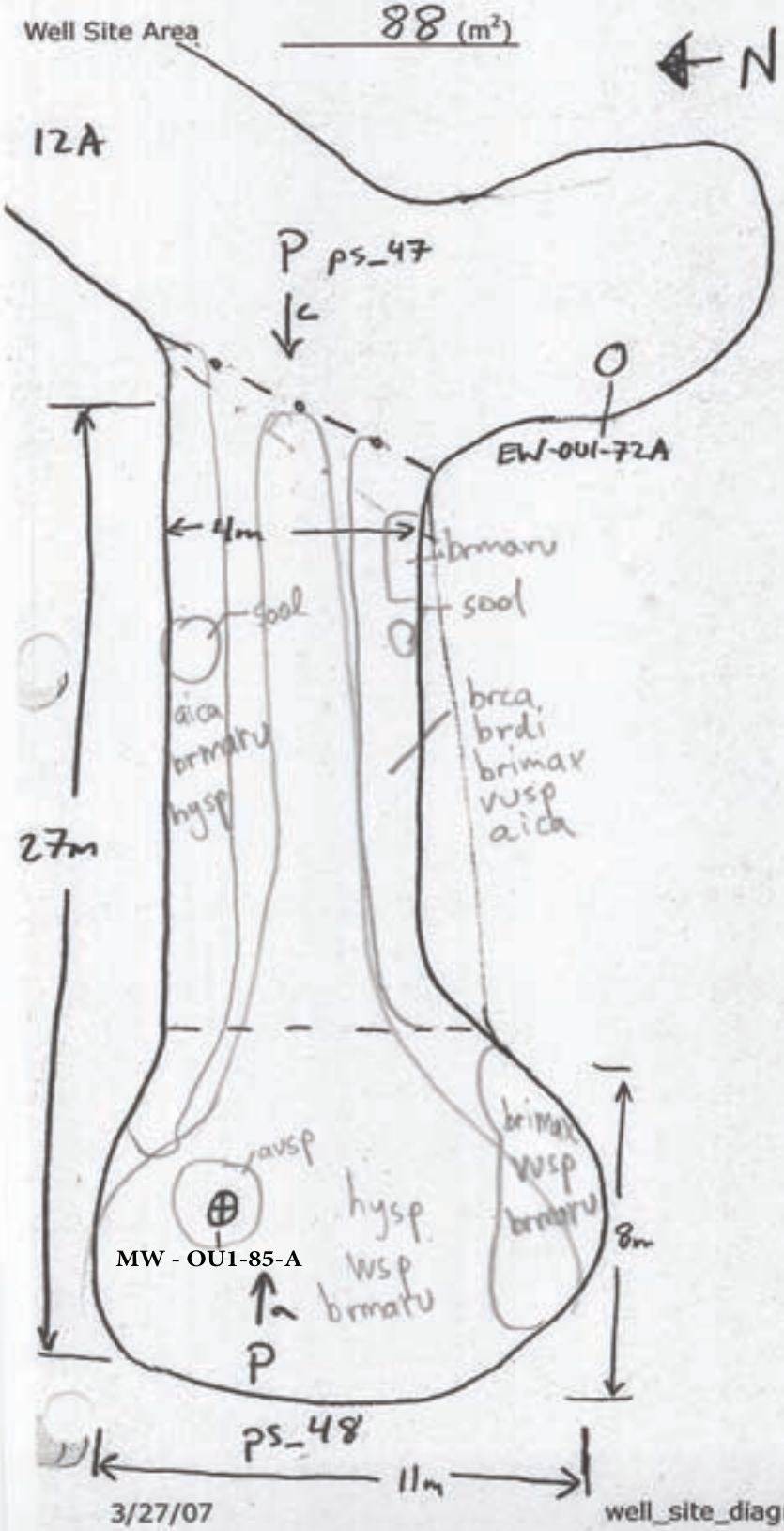
tal Aprox. Area 164 (m^2)

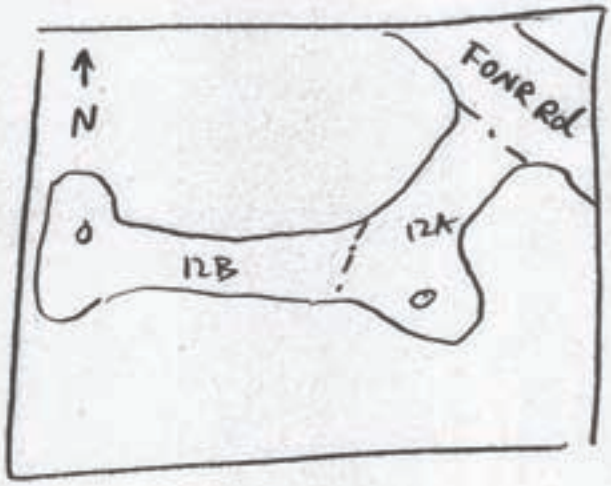
.ell Rd. Area 76 (m^2)

Well Site Area 88 (m^2)

Legend

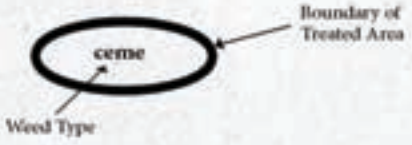
1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1ST TREATMENT

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-73A

WCS Sub Group: 13A

Date: 4/25/12

Surveyor: MJB

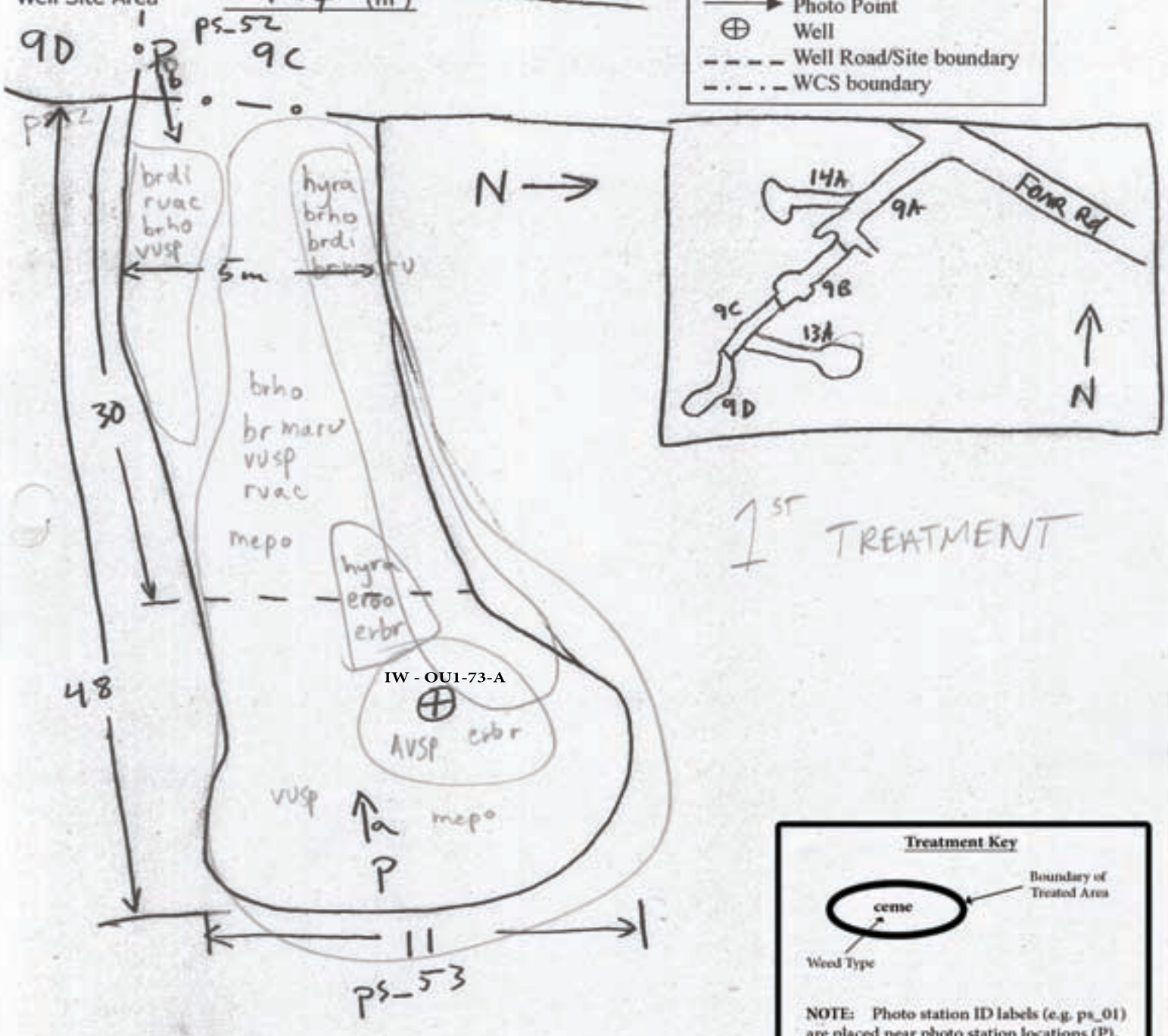
al Aprox. Area: 277 (m²)

ell Rd. Area: 150 (m²)

Well Site Area: 127 (m²)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-73A

WCS Sub Group 13A

Date 5/30/12

Surveyor MNB

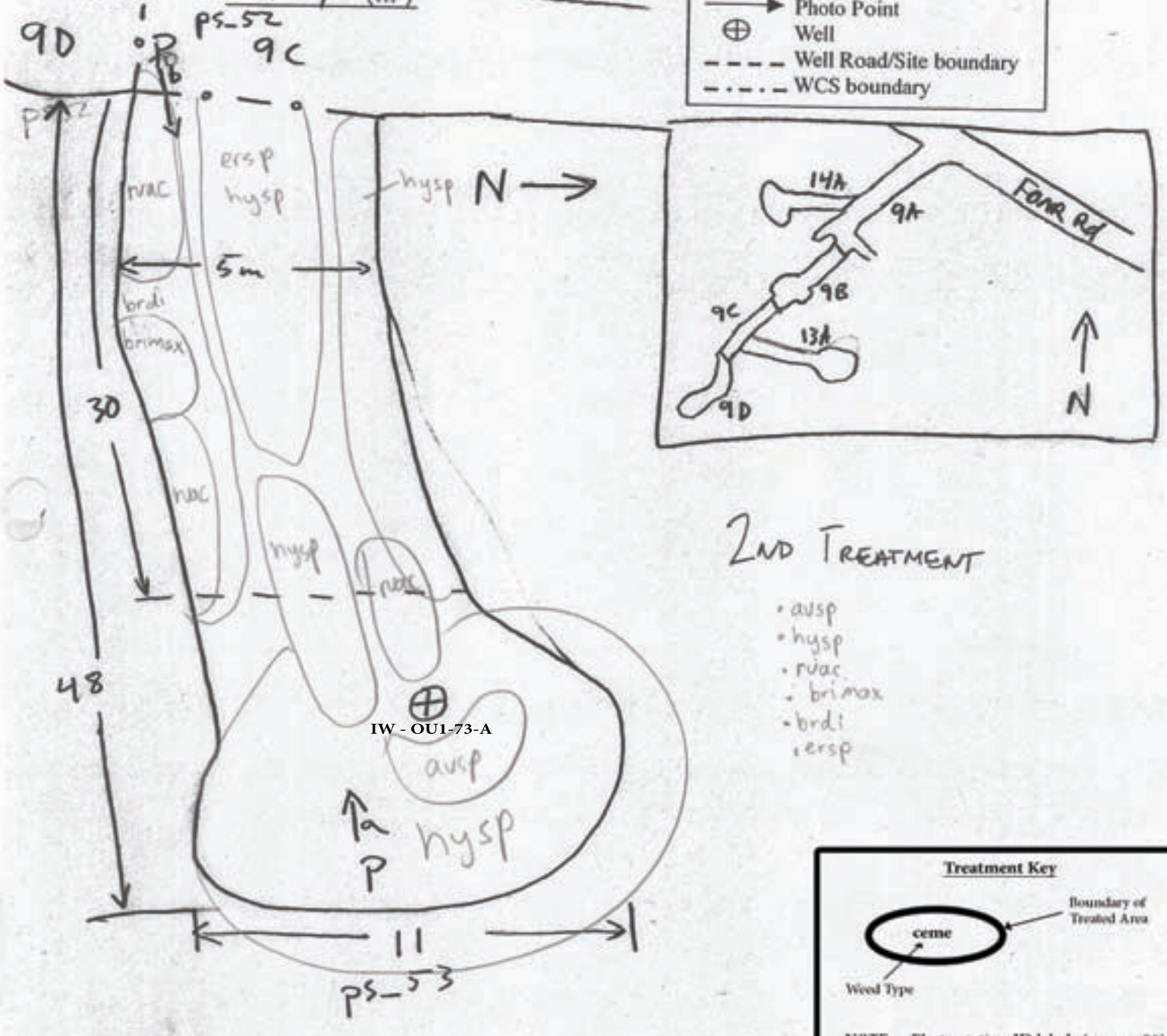
al Aprox. Area 277 (m^2)

ell Rd. Area 150 (m^2)

Well Site Area 127 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



IW - OU1-73-A

2ND TREATMENT

- avsp
- hysp
- rviac
- brimax
- brdl
- ersp

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-83A

WCS Sub Group 14A

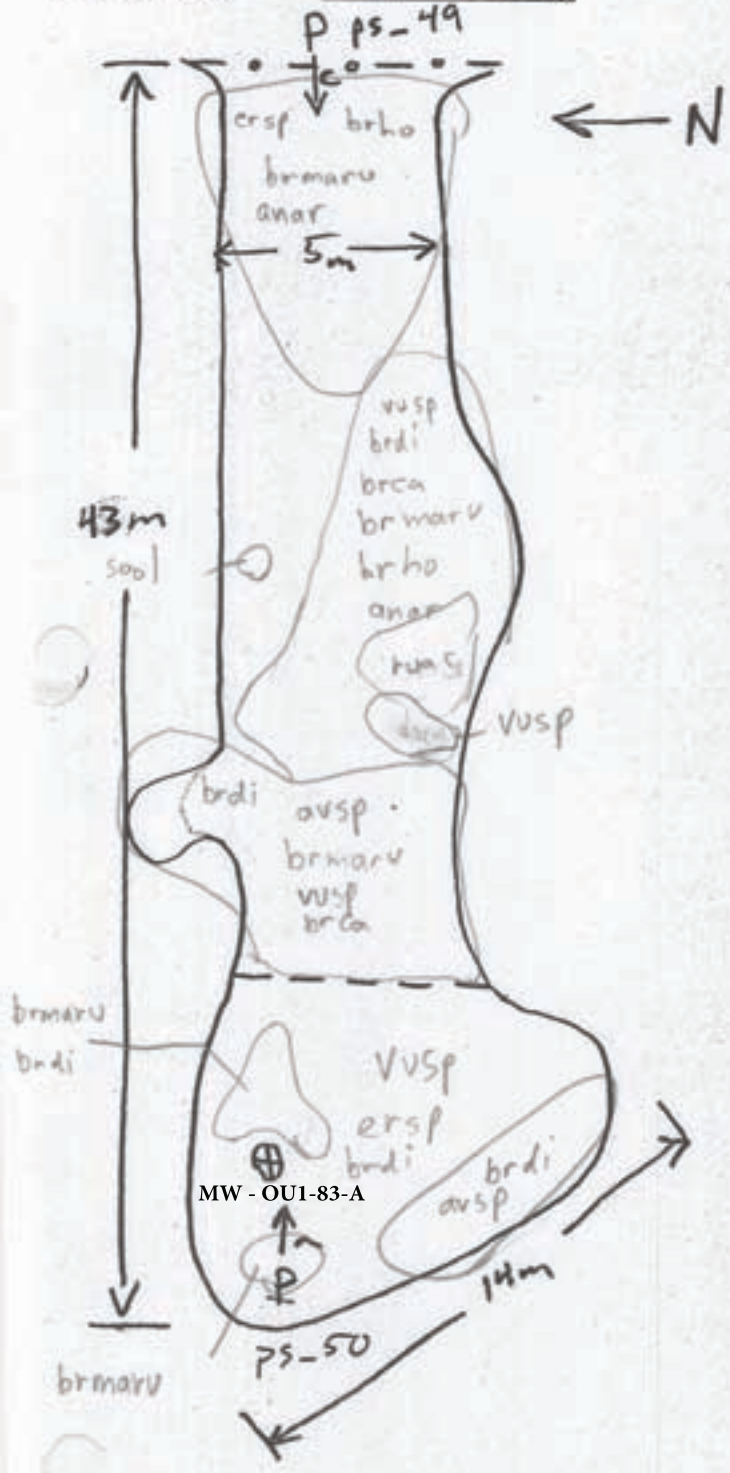
Date 4/26/12

Surveyor MNB

tal Aprox. Area 327 (m^2)

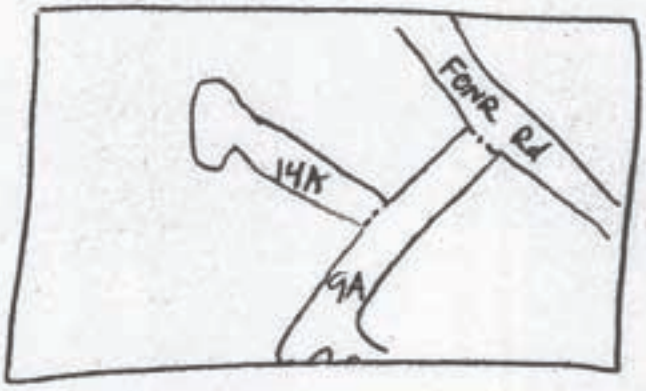
ell Rd. Area 215 (m^2)

Well Site Area 112 (m^2)



Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



1ST TREATMENT

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-83A

WCS Sub Group 14A

Total Aprox. Area 327 (m^2)

Well Rd. Area 215 (m^2)

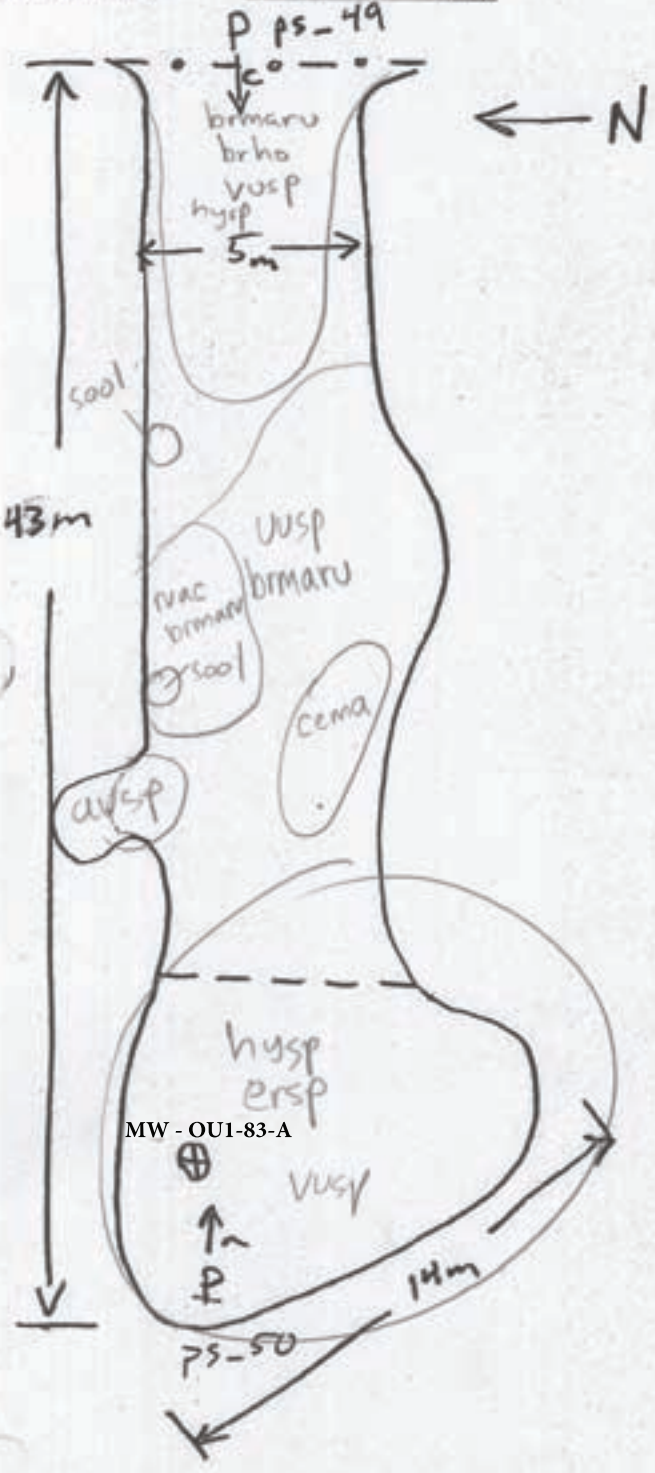
Well Site Area 112 (m^2)

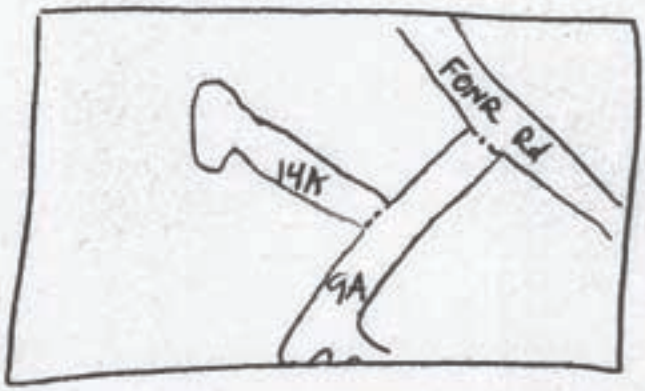
Date 5/30/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

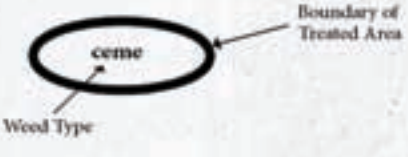




2ND TREATMENT

- brmaru
- brho
- vusp
- hysp
- cema
- sool
- ersp
- avsp
- ruac

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-82A

Date 5-16-12

WCS Sub Group 15A

Surveyor MNB

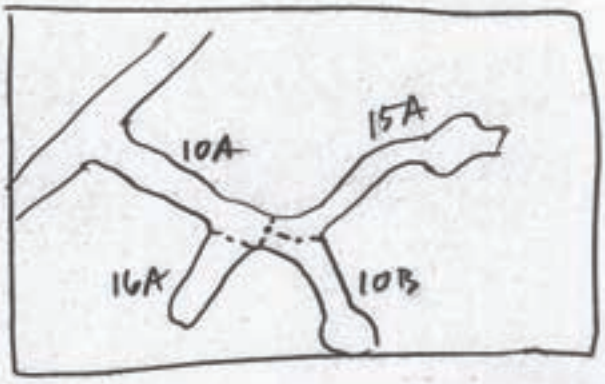
tal Aprox. Area 326 (m^2)

ell Rd. Area 208 (m^2)

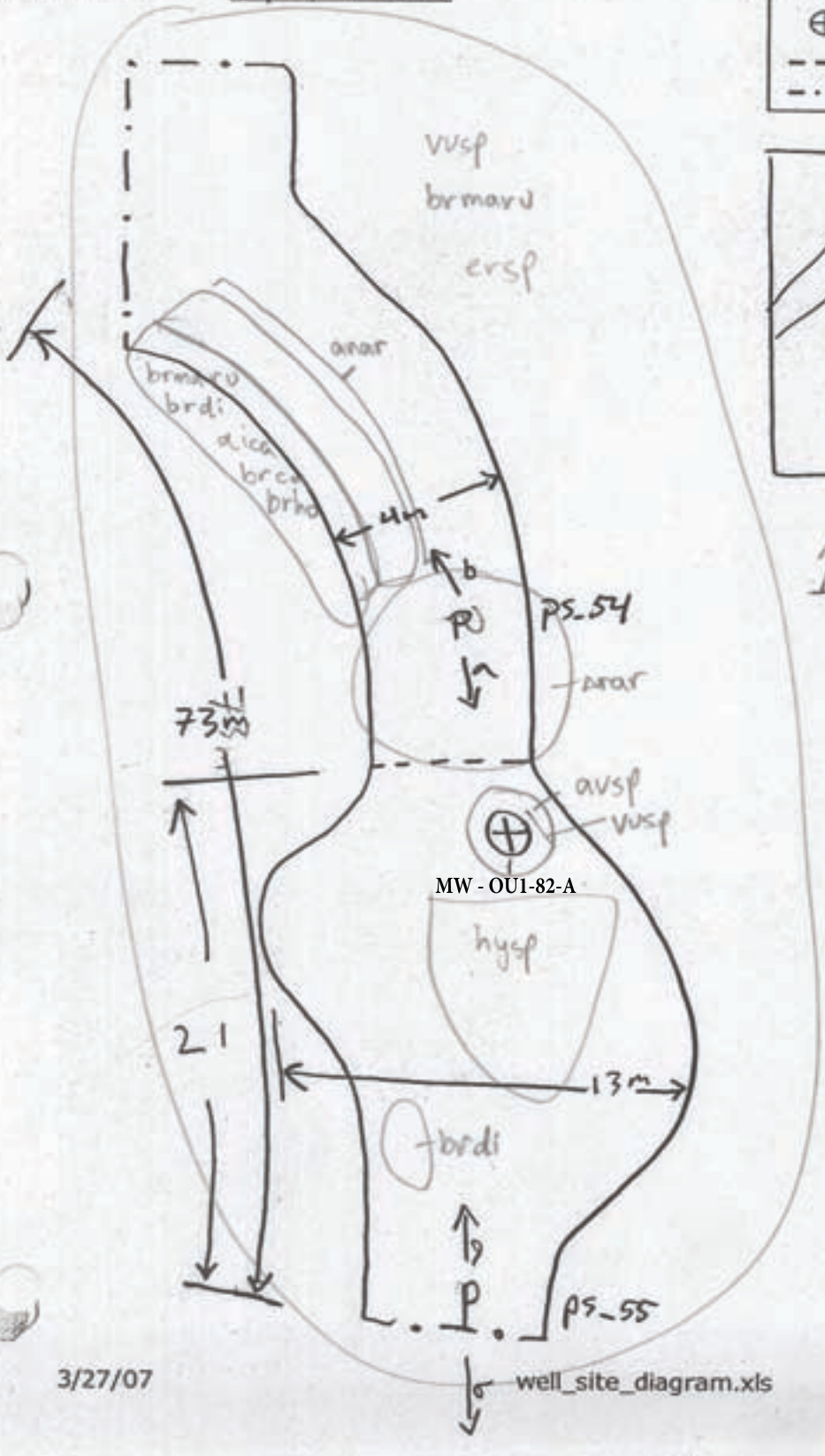
Well Site Area 118 (m^2)

Legend

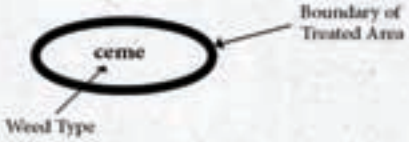
1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



1ST TREATMENT



Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: SB-OU1-2004-K

WCS Sub Group 16A

Total Aprox. Area 300 (m^2)

Well Rd. Area 160 (m^2)

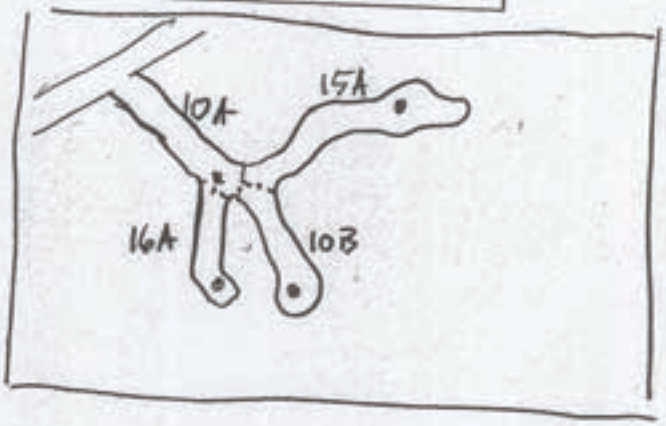
Well Site Area 140 (m^2)

Date 5-16-12

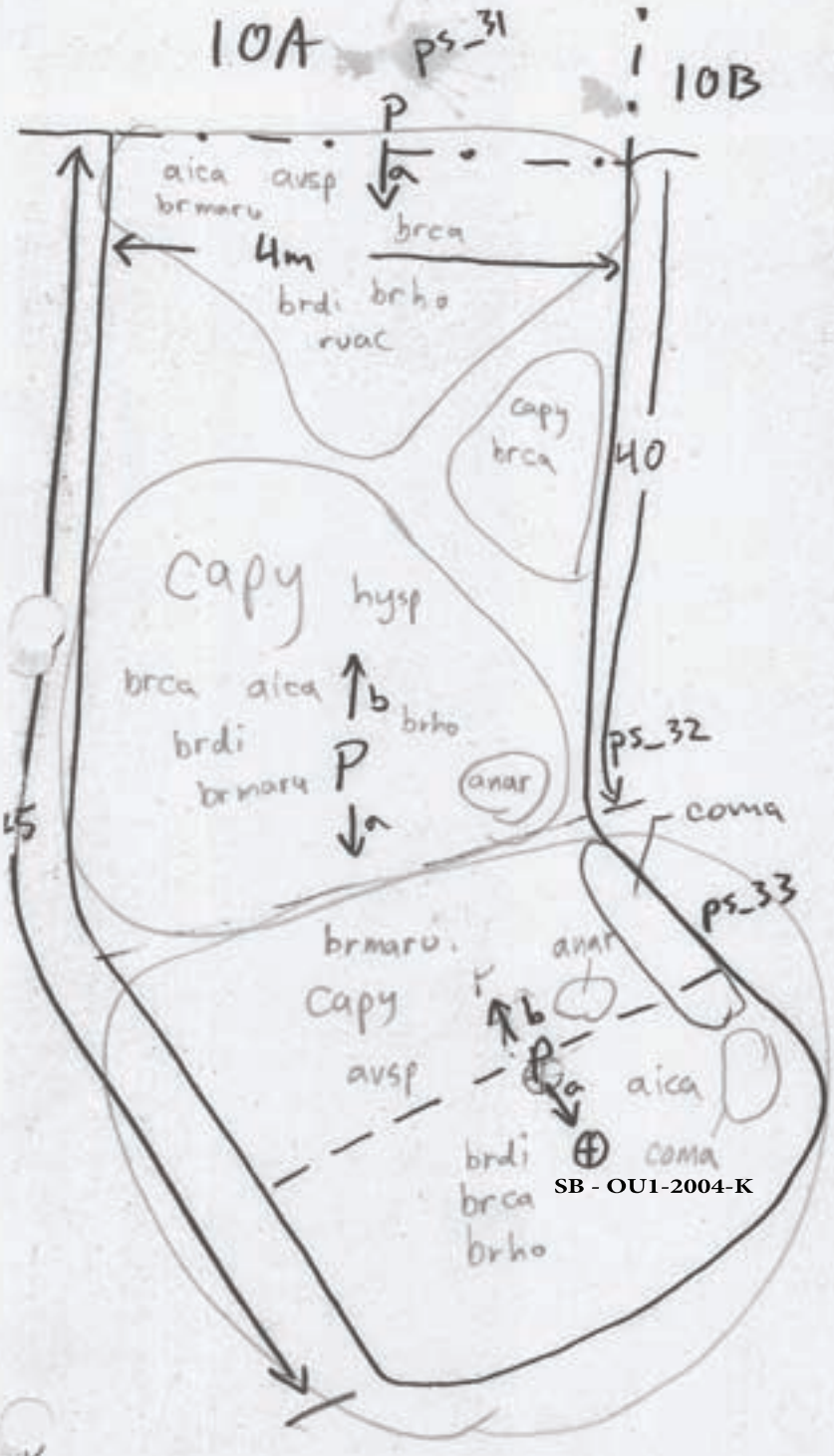
Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

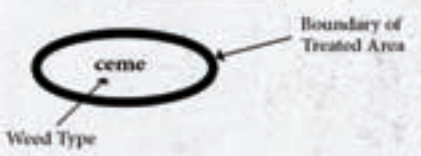


1ST TREATMENT



SB - OU1-2004-K

Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: PZ-OUI-02-A / IW-OUI-02-A

Date: 5/23/12

WCS Sub Group: 17A

Surveyor: MNB

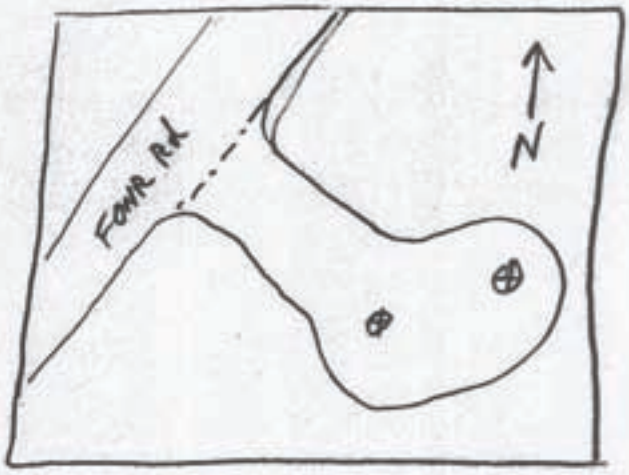
Total Aprox. Area: 100 (m^2)

Well Rd. Area: 48 (m^2)

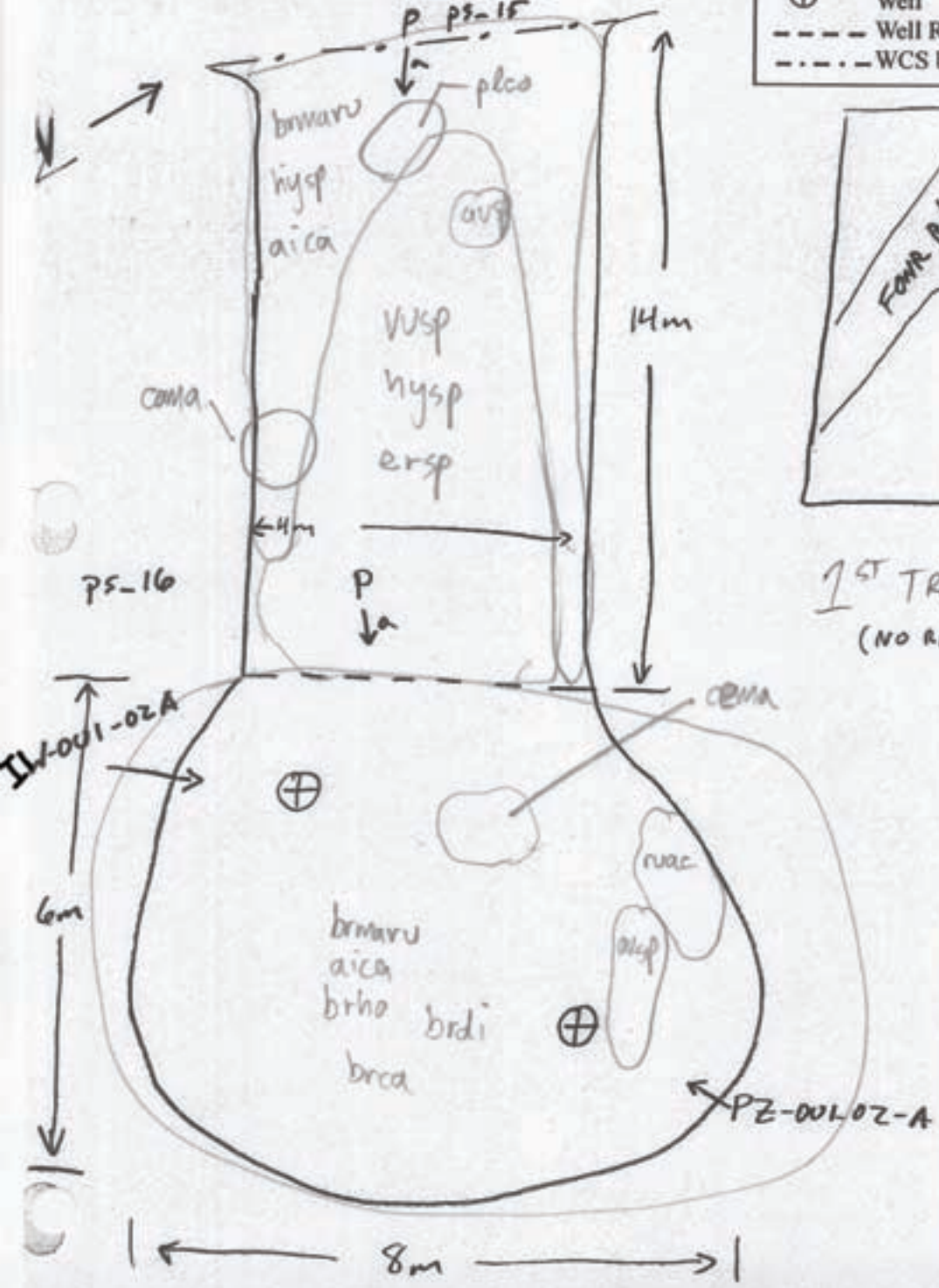
Well Site Area: 52 (m^2)

Legend

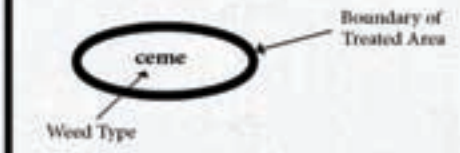
1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



1ST TREATMENT
(NO RARE PLANTS)



Treatment Key



NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-88-A

WCS Sub Group 18A

Total Aprox. Area 188 (m^2)

Well Rd. Area 56 (m^2)

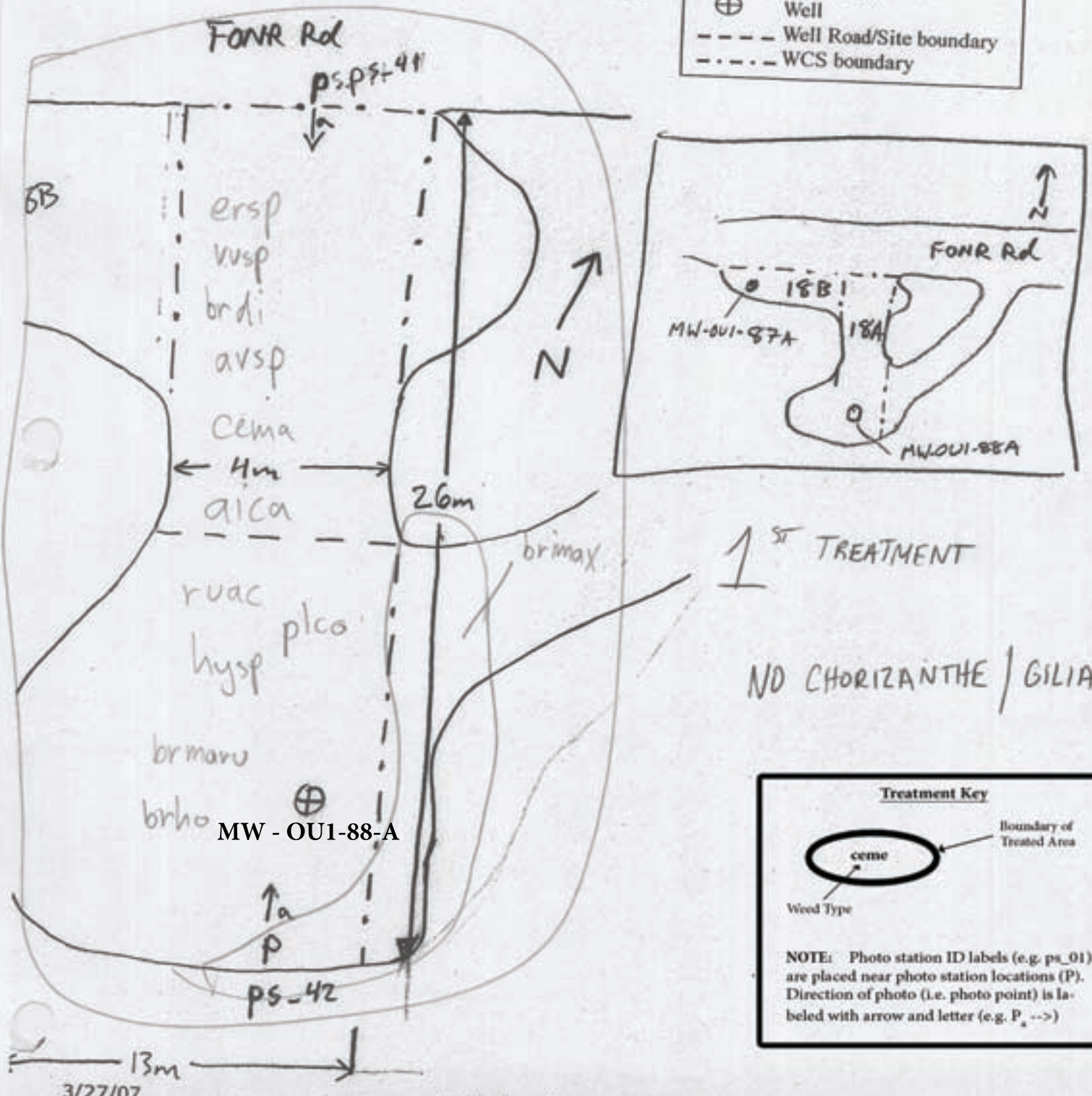
Well Site Area 102 (m^2)

Date 5/17/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

3/27/07

Attachment 2

‘RARE PLANT SURVEY DATA 2012’

The attached spreadsheet (HGL_WCS_RarePlant_2012.xls) contains rare plant survey data from pre-treatment rare plant surveys within each Weed Control Segment (WCS) during the 2012 weed control program within the Operable Unit 1 portion of the FONR.

HGL - WCS Rare Plant Survey Data 2012

sand gilia (*Gilia tenuiflora ssp. arenaria*) patch count and density class summary pivot table

Count of Patch ID	WCS	
Density	6A	Grand Total
L	6	6
VL	4	4
Grand Total	**10**	**10**

sand gilia (*Gilia tenuiflora ssp. arenaria*) patch area (m^2) and density class summary pivot table

Sum of Area (m2)	WCS	
Density	6A	Grand Total
L	6	6
VL	4	4
Grand Total	**10**	**10**

HGL - WCS Rare Plant Survey Data 2012

Monterey spineflower (*Chorizanthe pungens var. pungens*) patch count and cover class summary pivot table

Count of Patch ID	WCS																	
Coverage	**01A**	**02A**	**04A**	**05A**	**06A**	**07A**	**09A**	**09B**	**09C**	**09D**	**10A**	**10B**	**11A**	**12B**	**13A**	**14A**	**15A**	**16A**	**Grand Total**
H		1	2	6	1		2				3					3			**18**
M		2	2	10	4		6	1	3	1	6	4	1			6		1	**47**
S	2	1	3	13	2		7	1	4	1	5	4	2	2		3	1	1	**52**
VH				1							1					1			**3**
VS	12	8	7	15	5	2	7	8	8		2	8	2		1	3	18	2	**108**
Grand Total	**14**	**12**	**14**	**45**	**12**	**2**	**22**	**10**	**15**	**2**	**17**	**16**	**5**	**2**	**1**	**16**	**19**	**4**	**228**

Monterey spineflower (*Chorizanthe pungens var. pungens*) patch area (m^2) and cover class summary pivot table

Sum of Area (m2)	WCS																	
Coverage	**01A**	**02A**	**04A**	**05A**	**06A**	**07A**	**09A**	**09B**	**09C**	**09D**	**10A**	**10B**	**11A**	**12B**	**13A**	**14A**	**15A**	**16A**	**Grand Total**
H		8	9	44	30		41				44					23			**199**
M		11	9	41	15		45	9	26	12	35	18	2			46		6	**275**
S	10	5	11	31	12		16	2	22	15	19	10	8	8		25	2	3	**199**
VH				1							5					3			**9**
VS	21	12	15	30	10	2	16	24	23		4	14	2		1	10	20	2	**206**
Grand Total	**31**	**36**	**44**	**147**	**67**	**2**	**118**	**35**	**71**	**27**	**107**	**42**	**12**	**8**	**1**	**107**	**22**	**11**	**888**

HGL - WCS Rare Plant Survey Data 2012
sand gilia (*Gilia tenuiflora ssp. arenaria*) survey data

MNB = Mackneal Byers	*Gilia* density: Very High (VH): > 51 / m2 High (H): 21-50 / m2 Medium (M): 11-20 / m2 Low (L) 3-10 / m2 Very Low (VL): 1-2 / m2

Date	WCS	Well ID	Surveyor	Patch ID	Density	Area (m^2)
5/17/2012	6A	EW-OUI-53-A	MNB	MNB180	L	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB182	L	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB183	VL	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB184	L	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB185	VL	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB186	L	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB187	L	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB188	VL	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB189	L	1
5/17/2012	6A	EW-OUI-53-A	MNB	MNB190	VL	1

HGL - WCS Rare Plant Survey Data 2012
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

MNB = Mackneal Byers	Chorizanthe Coverage: Very High (VH): > 98 % coverage High (H): 76-97 % coverage Medium (M): 26-75 % coverage Sparse (S) 3-25 % coverage Very Sparse (VS): 1-2 % coverage

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
5/23/2012	1A	N/A	MNB	MNB219	VS	4
5/23/2012	1A	N/A	MNB	MNB220	VS	1
5/23/2012	1A	N/A	MNB	MNB221	VS	1
5/23/2012	1A	N/A	MNB	MNB222	VS	1
5/23/2012	1A	N/A	MNB	MNB223	S	6
5/23/2012	1A	N/A	MNB	MNB224	VS	3
5/23/2012	1A	N/A	MNB	MNB225	VS	1
5/23/2012	1A	N/A	MNB	MNB226	VS	1
5/23/2012	1A	N/A	MNB	MNB227	VS	1
5/23/2012	1A	N/A	MNB	MNB228	VS	1
5/23/2012	1A	N/A	MNB	MNB229	S	4
5/23/2012	1A	N/A	MNB	MNB230	VS	1
5/23/2012	1A	N/A	MNB	MNB231	VS	1
5/23/2012	1A	N/A	MNB	MNB232	VS	5
5/23/2012	2A	N/A	MNB	MNB207	S	5
5/23/2012	2A	N/A	MNB	MNB208	VS	2
5/23/2012	2A	N/A	MNB	MNB209	VS	1
5/23/2012	2A	N/A	MNB	MNB210	VS	4
5/23/2012	2A	N/A	MNB	MNB211	VS	1
5/23/2012	2A	N/A	MNB	MNB212	VS	1
5/23/2012	2A	N/A	MNB	MNB213	VS	1
5/23/2012	2A	N/A	MNB	MNB214	VS	1
5/23/2012	2A	N/A	MNB	MNB215	M	6
5/23/2012	2A	N/A	MNB	MNB216	VS	1
5/23/2012	2A	N/A	MNB	MNB217	M	5
5/23/2012	2A	N/A	MNB	MNB218	H	8
5/23/2012	4A	IW-OU1-05-A	MNB	MNB193	VS	1
5/23/2012	4A	IW-OU1-05-A	MNB	MNB194	VS	1
5/23/2012	4A	IW-OU1-05-A	MNB	MNB195	M	4
5/23/2012	4A	IW-OU1-05-A	MNB	MNB196	S	5
5/23/2012	4A	IW-OU1-05-A	MNB	MNB197	VS	3
5/23/2012	4A	IW-OU1-05-A	MNB	MNB198	S	3
5/23/2012	4A	IW-OU1-05-A	MNB	MNB199	M	5
5/23/2012	4A	IW-OU1-05-A	MNB	MNB200	H	5
5/23/2012	4A	IW-OU1-05-A	MNB	MNB201	S	3
5/23/2012	4A	IW-OU1-05-A	MNB	MNB202	H	4
5/23/2012	4A	IW-OU1-05-A	MNB	MNB203	VS	3
5/23/2012	4A	IW-OU1-05-A	MNB	MNB204	VS	1
5/23/2012	4A	IW-OU1-05-A	MNB	MNB204	VS	1
5/23/2012	4A	IW-OU1-05-A	MNB	MNB204	VS	5
4/11/2012	05A	IW-OU1-01-A	MNB	MNB001	VS	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB002	S	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB003	VS	1

HGL - WCS Rare Plant Survey Data 2012
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
4/11/2012	05A	IW-OU1-01-A	MNB	MNB004	S	3
4/11/2012	05A	IW-OU1-01-A	MNB	MNB005	VS	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB006	S	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB007	VS	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB008	VS	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB009	VS	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB010	VS	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB011	S	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB012	VS	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB013	M	3
4/11/2012	05A	IW-OU1-01-A	MNB	MNB014	S	4
4/11/2012	05A	IW-OU1-01-A	MNB	MNB015	S	2
4/11/2012	05A	IW-OU1-01-A	MNB	MNB016	M	1
4/11/2012	05A	IW-OU1-01-A	MNB	MNB017	H	2
4/11/2012	05A	IW-OU1-01-A	MNB	MNB018	M	2
4/11/2012	05A	IW-OU1-01-A	MNB	MNB019	M	2
4/11/2012	05A	IW-OU1-01-A	MNB	MNB020	S	3
4/11/2012	05A	IW-OU1-01-A	MNB	MNB021	M	3
4/11/2012	05A	IW-OU1-01-A	MNB	MNB022	S	4
4/12/2012	05A	IW-OU1-01-A	MNB	MNB023	VS	1
4/12/2012	05A	IW-OU1-01-A	MNB	MNB024	H	2
4/12/2012	05A	IW-OU1-01-A	MNB	MNB025	VS	1
4/12/2012	05A	IW-OU1-01-A	MNB	MNB026	S	1
4/12/2012	05A	IW-OU1-01-A	MNB	MNB027	VS	8
4/12/2012	05A	IW-OU1-01-A	MNB	MNB028	M	1
4/12/2012	05A	IW-OU1-01-A	MNB	MNB029	S	1
4/12/2012	05A	IW-OU1-01-A	MNB	MNB030	M	4
4/12/2012	05A	IW-OU1-01-A	MNB	MNB031	VS	5
4/12/2012	05A	IW-OU1-01-A	MNB	MNB032	M	5
4/12/2012	05A	IW-OU1-01-A	MNB	MNB033	H	7
4/12/2012	05A	IW-OU1-01-A	MNB	MNB034	S	2
4/12/2012	05A	IW-OU1-01-A	MNB	MNB035	VS	5
4/12/2012	05A	IW-OU1-01-A	MNB	MNB036	VH	1
4/12/2012	05A	IW-OU1-01-A	MNB	MNB037	VS	1
4/12/2012	05A	IW-OU1-01-A	MNB	MNB038	S	7
4/12/2012	05A	IW-OU1-01-A	MNB	MNB039	H	4
4/12/2012	05A	IW-OU1-01-A	MNB	MNB040	H	25
4/12/2012	05A	IW-OU1-01-A	MNB	MNB041	H	4
4/12/2012	05A	IW-OU1-01-A	MNB	MNB042	M	18
4/12/2012	05A	IW-OU1-01-A	MNB	MNB043	M	2
4/12/2012	05A	IW-OU1-01-A	MNB	MNB044	VS	1
4/12/2012	05A	IW-OU1-01-A	MNB	MNB045	S	1
5/16/2012	06A	EW-OU1-53-A	MNB	MNB168	M	1
5/16/2012	06A	EW-OU1-53-A	MNB	MNB169	S	8
5/16/2012	06A	EW-OU1-53-A	MNB	MNB170	S	4
5/16/2012	06A	EW-OU1-53-A	MNB	MNB171	H	30
5/16/2012	06A	EW-OU1-53-A	MNB	MNB172	M	8
5/16/2012	06A	EW-OU1-53-A	MNB	MNB173	M	1
5/16/2012	06A	EW-OU1-53-A	MNB	MNB174	VS	1
5/16/2012	06A	EW-OU1-53-A	MNB	MNB175	VS	1
5/16/2012	06A	EW-OU1-53-A	MNB	MNB176	VS	3
5/16/2012	06A	EW-OU1-53-A	MNB	MNB177	VS	4

HGL - WCS Rare Plant Survey Data 2012
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
5/16/2012	06A	EW-OU1-53-A	MNB	MNB178	M	5
5/16/2012	06A	EW-OU1-53-A	MNB	MNB179	VS	1
5/17/2012	07A	EW-OU1-52A	MNB	MNB191	VS	1
5/17/2012	07A	EW-OU1-52A	MNB	MNB192	VS	1
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB046	VS	1
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB047	S	3
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB048	VS	2
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB049	VS	2
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB050	VS	1
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB051	H	4
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB052	M	1
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB053	M	2
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB054	S	1
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB055	M	20
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB056	S	2
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB057	M	9
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB058	H	37
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB059	M	10
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB060	VS	1
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB061	S	2

HGL - WCS Rare Plant Survey Data 2012
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB062	S	2
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB063	VS	8
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB064	S	5
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB065	M	3
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB066	S	1
4/18/2012	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	MNB	MNB067	VS	1
4/19/2012	09B	MW-OU1-84A	MNB	MNB084	VS	1
4/19/2012	09B	MW-OU1-84A	MNB	MNB085	VS	1
4/19/2012	09B	MW-OU1-84A	MNB	MNB086	VS	1
4/19/2012	09B	MW-OU1-84A	MNB	MNB087	VS	1
4/19/2012	09B	MW-OU1-84A	MNB	MNB088	VS	17
4/19/2012	09B	MW-OU1-84A	MNB	MNB089	VS	1
4/19/2012	09B	MW-OU1-84A	MNB	MNB090	S	2
4/19/2012	09B	MW-OU1-84A	MNB	MNB091	VS	1
4/19/2012	09B	MW-OU1-84A	MNB	MNB092	VS	1
4/19/2012	09B	MW-OU1-84A	MNB	MNB093	M	9
4/25/2012	09C	IW-OU1-74A	MNB	MNB094	M	17
4/25/2012	09C	IW-OU1-74A	MNB	MNB095	S	17
4/25/2012	09C	IW-OU1-74A	MNB	MNB096	M	4
4/25/2012	09C	IW-OU1-74A	MNB	MNB097	VS	3
4/25/2012	09C	IW-OU1-74A	MNB	MNB098	S	2
4/25/2012	09C	IW-OU1-74A	MNB	MNB099	M	5
4/25/2012	09C	IW-OU1-74A	MNB	MNB100	S	2
4/25/2012	09C	IW-OU1-74A	MNB	MNB101	VS	3
4/25/2012	09C	IW-OU1-74A	MNB	MNB102	VS	4
4/25/2012	09C	IW-OU1-74A	MNB	MNB103	VS	2
4/25/2012	09C	IW-OU1-74A	MNB	MNB104	VS	1
4/25/2012	09C	IW-OU1-74A	MNB	MNB105	VS	1
4/25/2012	09C	IW-OU1-74A	MNB	MNB106	VS	2
4/25/2012	09C	IW-OU1-74A	MNB	MNB107	VS	7
4/25/2012	09C	IW-OU1-74A	MNB	MNB108	S	1
4/25/2012	09D	MW-OUI-51A	MNB	MNB109	M	12
4/25/2012	09D	MW-OUI-51A	MNB	MNB110	S	15
4/26/2012	10A	MW-OUI-50A	MNB	MNB112	S	1
4/26/2012	10A	MW-OUI-50A	MNB	MNB113	S	6
4/26/2012	10A	MW-OUI-50A	MNB	MNB114	S	2
4/26/2012	10A	MW-OUI-50A	MNB	MNB115	VS	2
4/26/2012	10A	MW-OUI-50A	MNB	MNB116	M	8
4/26/2012	10A	MW-OUI-50A	MNB	MNB117	S	3
4/26/2012	10A	MW-OUI-50A	MNB	MNB118	H	6

HGL - WCS Rare Plant Survey Data 2012
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
4/26/2012	10A	MW-OUI-50A	MNB	MNB119	M	5
4/26/2012	10A	MW-OUI-50A	MNB	MNB120	VS	2
4/26/2012	10A	MW-OUI-50A	MNB	MNB121	H	8
4/26/2012	10A	MW-OUI-50A	MNB	MNB122	M	5
4/26/2012	10A	MW-OUI-50A	MNB	MNB123	M	4
4/26/2012	10A	MW-OUI-50A	MNB	MNB124	H	30
4/26/2012	10A	MW-OUI-50A	MNB	MNB125	VH	5
4/26/2012	10A	MW-OUI-50A	MNB	MNB126	M	5
4/26/2012	10A	MW-OUI-50A	MNB	MNB127	S	7
4/26/2012	10A	MW-OUI-50A	MNB	MNB128	M	8
4/26/2012	10B	MW-OUI-59A	MNB	MNB129	S	3
4/26/2012	10B	MW-OUI-59A	MNB	MNB130	VS	2
4/26/2012	10B	MW-OUI-59A	MNB	MNB131	VS	2
4/26/2012	10B	MW-OUI-59A	MNB	MNB132	VS	1
4/26/2012	10B	MW-OUI-59A	MNB	MNB133	VS	1
4/26/2012	10B	MW-OUI-59A	MNB	MNB134	VS	1
4/26/2012	10B	MW-OUI-59A	MNB	MNB135	S	1
4/26/2012	10B	MW-OUI-59A	MNB	MNB136	M	6
4/26/2012	10B	MW-OUI-59A	MNB	MNB137	VS	1
4/26/2012	10B	MW-OUI-59A	MNB	MNB138	S	2
4/26/2012	10B	MW-OUI-59A	MNB	MNB139	M	7
4/26/2012	10B	MW-OUI-59A	MNB	MNB140	S	4
4/26/2012	10B	MW-OUI-59A	MNB	MNB141	VS	4
4/26/2012	10B	MW-OUI-59A	MNB	MNB142	M	3
4/26/2012	10B	MW-OUI-59A	MNB	MNB143	M	2
4/26/2012	10B	MW-OUI-59A	MNB	MNB144	VS	2
5/24/2012	11A	EW-OU1-71A	MNB	MNB233	S	6
5/24/2012	11A	EW-OU1-71A	MNB	MNB234	VS	1
5/24/2012	11A	EW-OU1-71A	MNB	MNB235	S	2
5/24/2012	11A	EW-OU1-71A	MNB	MNB236	M	2
5/24/2012	11A	EW-OU1-71A	MNB	MNB237	VS	1
5/24/2012	12B	MW-OU1-85A	MNB	MNB238	S	2
5/24/2012	12B	MW-OU1-85A	MNB	MNB239	S	6
4/25/2012	13A	IW-OU1-73A	MNB	MNB111	VS	1
4/18/2012	14A	MW-OU1-83A	MNB	MNB068	M	15
4/18/2012	14A	MW-OU1-83A	MNB	MNB069	S	15
4/18/2012	14A	MW-OU1-83A	MNB	MNB070	VS	1
4/18/2012	14A	MW-OU1-83A	MNB	MNB071	M	4
4/18/2012	14A	MW-OU1-83A	MNB	MNB072	VS	1
4/18/2012	14A	MW-OU1-83A	MNB	MNB073	M	8
4/18/2012	14A	MW-OU1-83A	MNB	MNB074	M	5
4/18/2012	14A	MW-OU1-83A	MNB	MNB075	H	12
4/18/2012	14A	MW-OU1-83A	MNB	MNB076	M	4
4/18/2012	14A	MW-OU1-83A	MNB	MNB077	M	10
4/18/2012	14A	MW-OU1-83A	MNB	MNB078	H	3
4/19/2012	14A	MW-OU1-83A	MNB	MNB079	S	7
4/19/2012	14A	MW-OU1-83A	MNB	MNB080	H	8
4/19/2012	14A	MW-OU1-83A	MNB	MNB081	VH	3
4/19/2012	14A	MW-OU1-83A	MNB	MNB082	VS	8
4/19/2012	14A	MW-OU1-83A	MNB	MNB083	S	3
5/16/2012	15A	MW-OU1-82A	MNB	MNB149	VS	2
5/16/2012	15A	MW-OU1-82A	MNB	MNB150	VS	1

HGL - WCS Rare Plant Survey Data 2012
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
5/16/2012	15A	MW-OU1-82A	MNB	MNB151	S	2
5/16/2012	15A	MW-OU1-82A	MNB	MNB152	VS	2
5/16/2012	15A	MW-OU1-82A	MNB	MNB153	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB154	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB155	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB156	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB157	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB158	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB159	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB160	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB161	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB162	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB163	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB164	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB165	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB166	VS	1
5/16/2012	15A	MW-OU1-82A	MNB	MNB167	VS	1
5/16/2012	16A	SB-OU1-2004K	MNB	MNB145	S	3
5/16/2012	16A	SB-OU1-2004K	MNB	MNB146	VS	1
5/16/2012	16A	SB-OU1-2004K	MNB	MNB147	M	6
5/16/2012	16A	SB-OU1-2004K	MNB	MNB148	VS	1

Attachment 3

‘RARE PLANT SURVEY DIAGRAMS 2012’

The attached diagrams show the distribution of rare plant species found during pre-treatment surveys within each Weed Control Segment (WCS) during the 2012 weed control program within the Operable Unit 1 portion of the FONR. These diagrams (not drawn to scale) also show the spatial extent, well location, well site/road boundaries, and photo stations/points for each WCS.

Well Site/Road Diagram

Well ID: N/A

Date 5/23/12

WCS Sub Group W1

Surveyor MNB

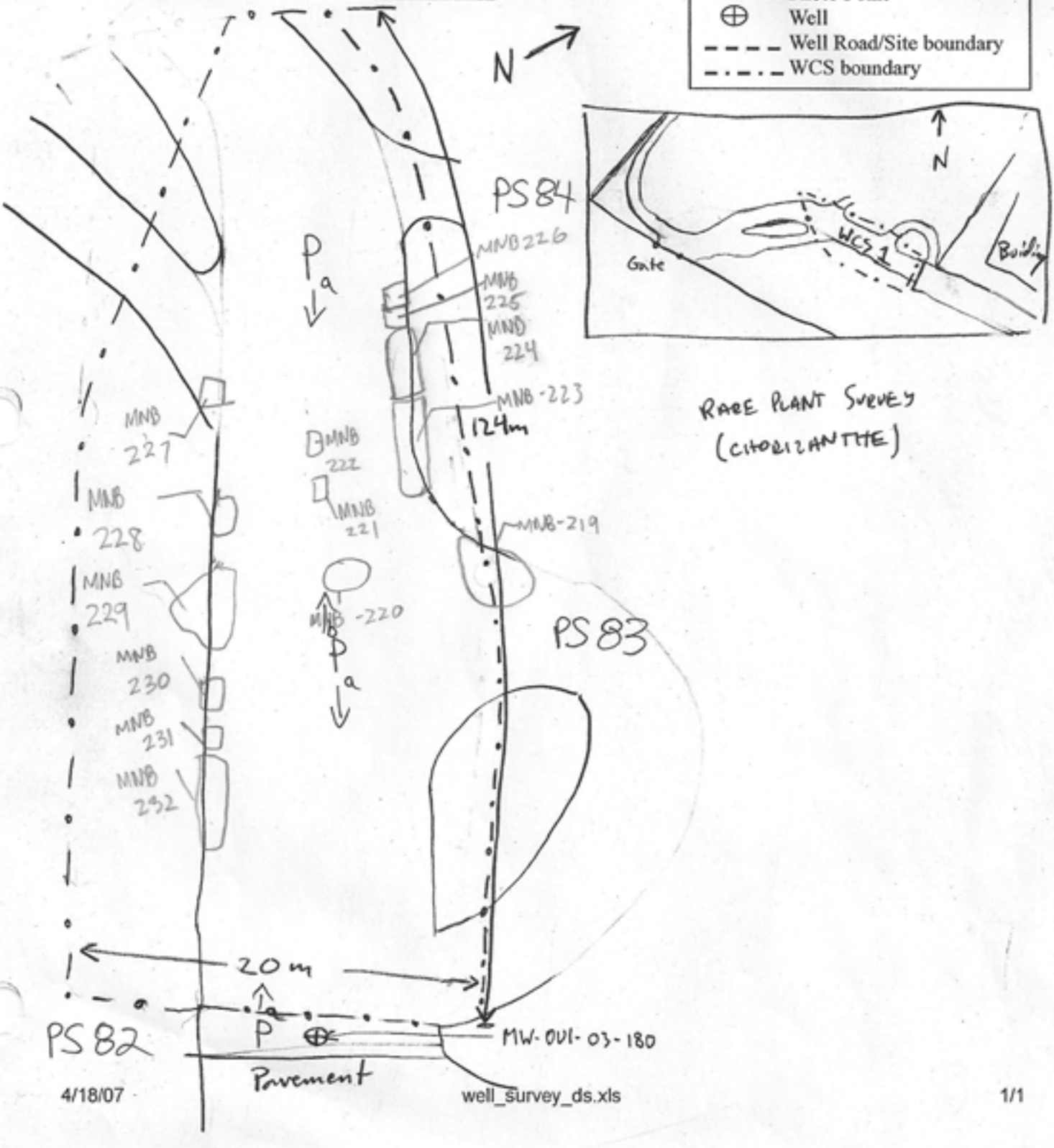
Total Aprox. Area 2,480 (m²)

Well Rd. Area (m²)

Well Site Area N/A (m²)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



RARE PLANT SURVEY (CITORIZANTHE)

Well Site/Road Diagram

Well ID: N/A

WCS Sub Group 2

Total Aprox. Area 418 (m²)

Well Rd. Area N/A (m²)

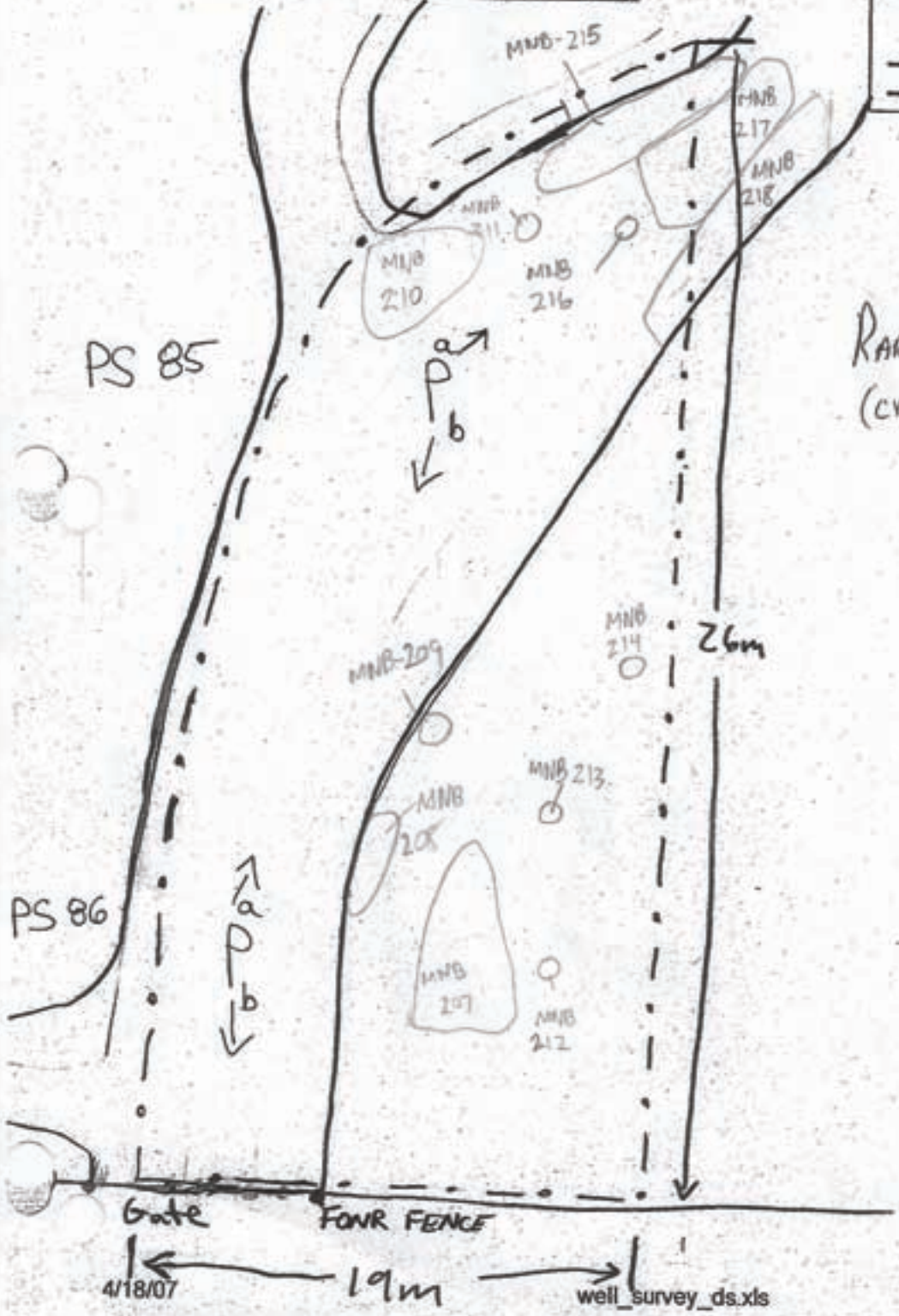
Well Site Area N/A (m²)

Date 5/23/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Well ID: IW-OU1-05A

Date 5/23/12

WCS Sub Group 4A

Surveyor MNB

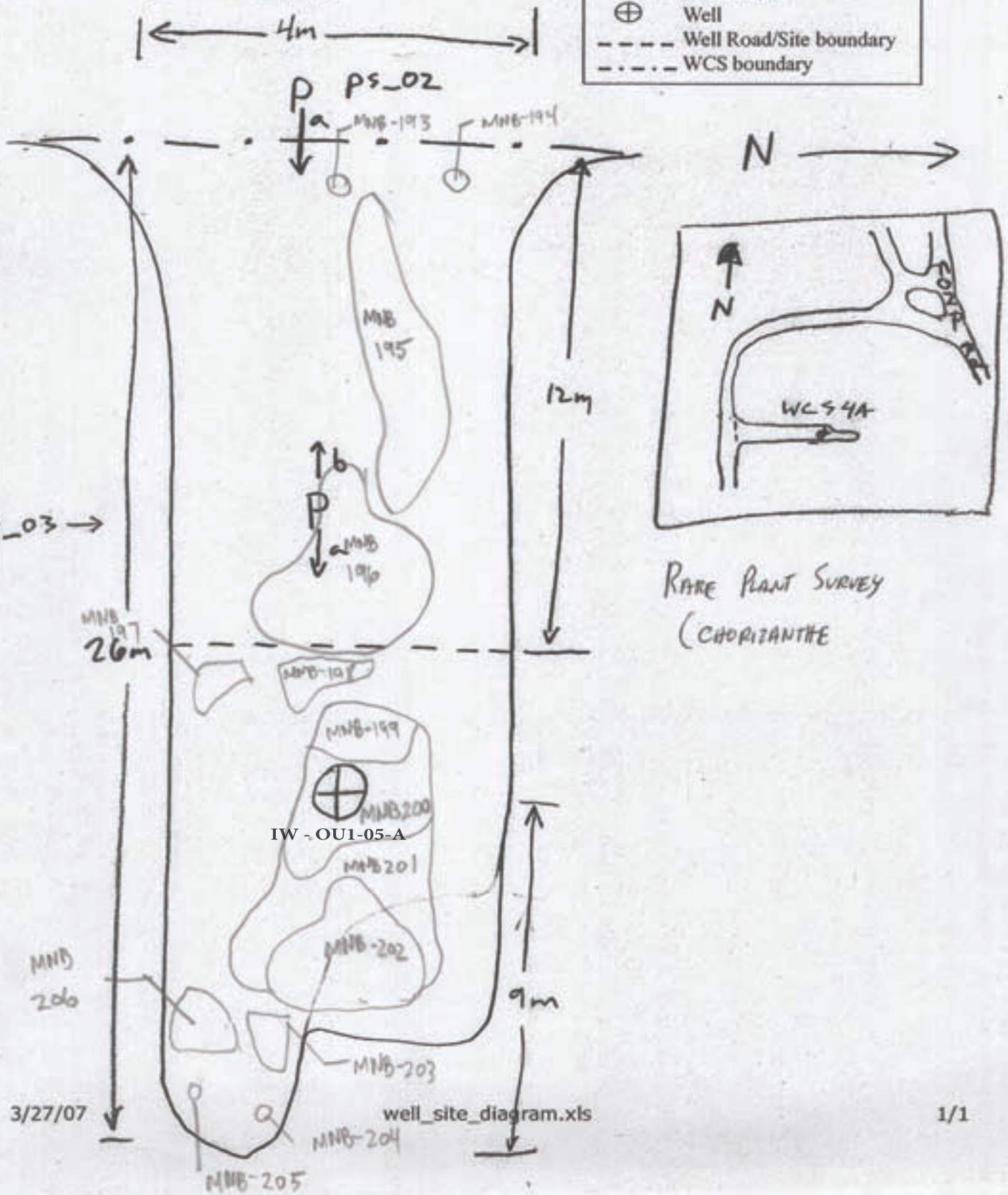
..tal Aprox. Area 94 (m^2)

..ell Rd. Area 48 (m^2)

Well Site Area 46m (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



IW - OU1-05-A

Well ID: IW-OU1-01-A

Date 4/11/12

WCS Sub Group 5-A

Surveyor MNB

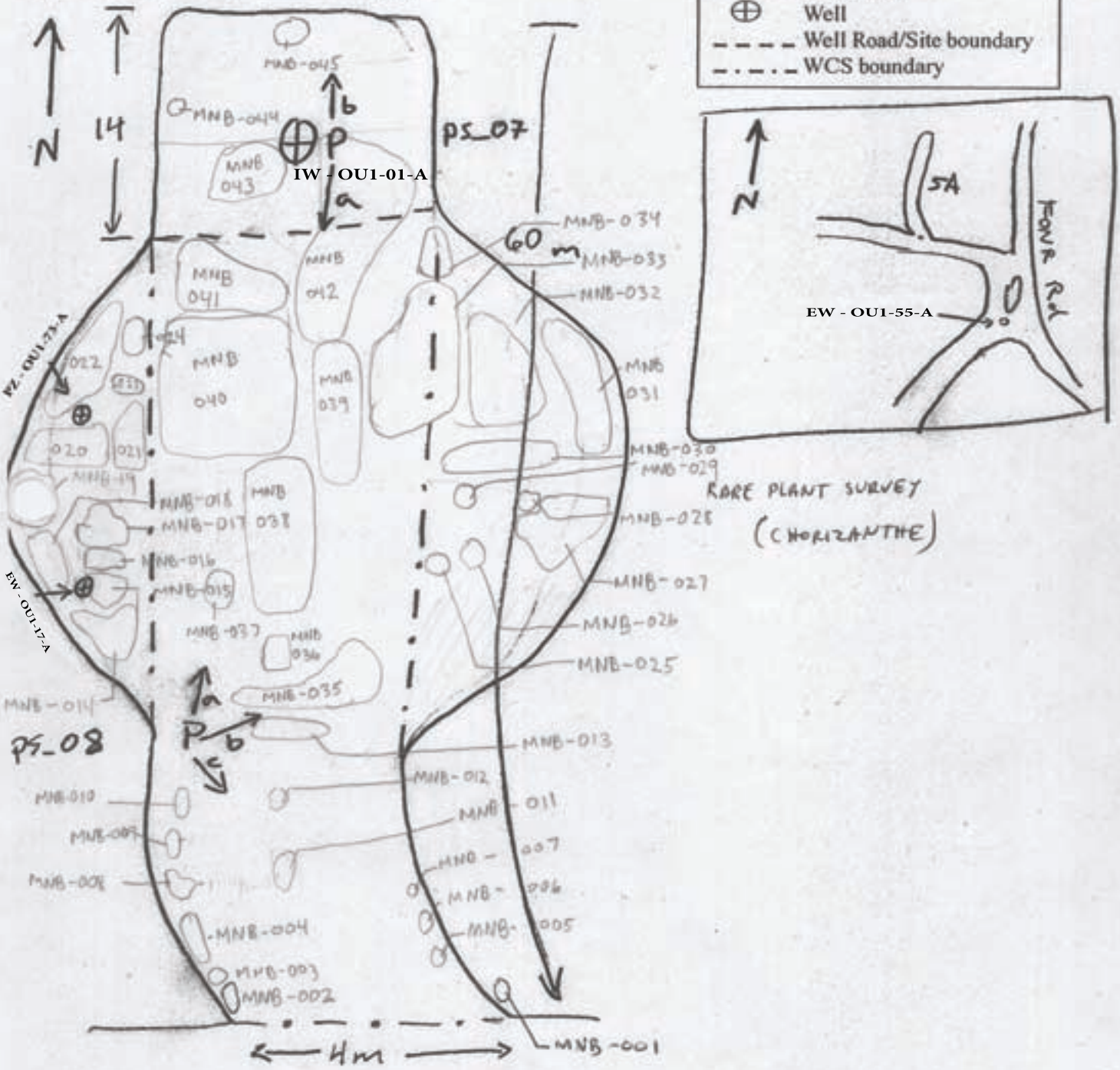
tal Aprox. Area 240 (m^2)

Well Rd. Area 174 (m^2)

Well Site Area 56 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



RARE PLANT SURVEY
(CHORIZANTHE)

Access Rd

Well ID: EW-OU1-53-A

Date 5-16-12

WCS Sub Group 6A

Surveyor MNB

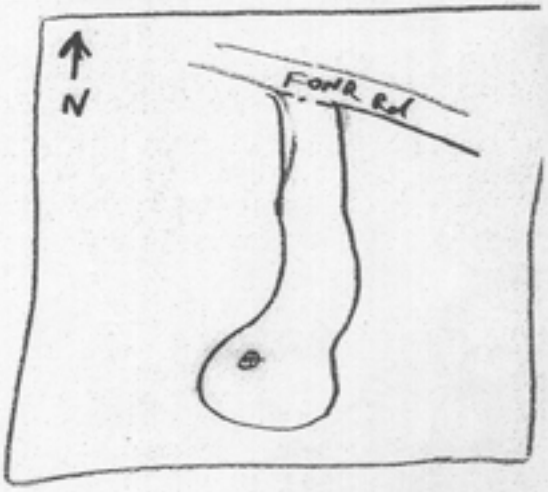
Total Aprox. Area 220 (m^2)

Well Rd. Area 138 (m^2)

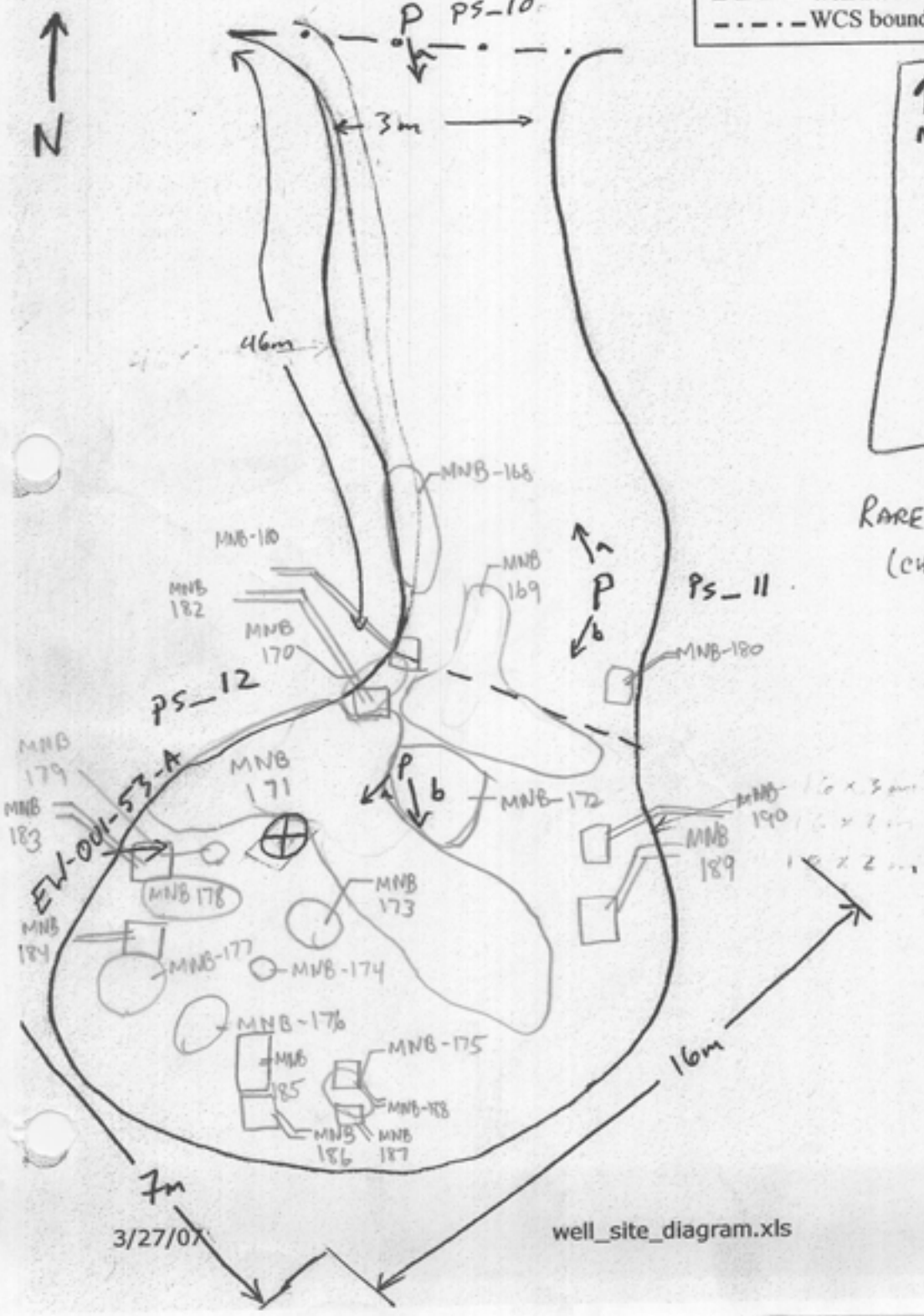
Well Site Area 82 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



RARE PLANT SURVEY
(CHORIZANTHE) & GILIA



Well ID: EW-OU1-52A

Date 5/17/12

WCS Sub Group 7A

Surveyor MNB

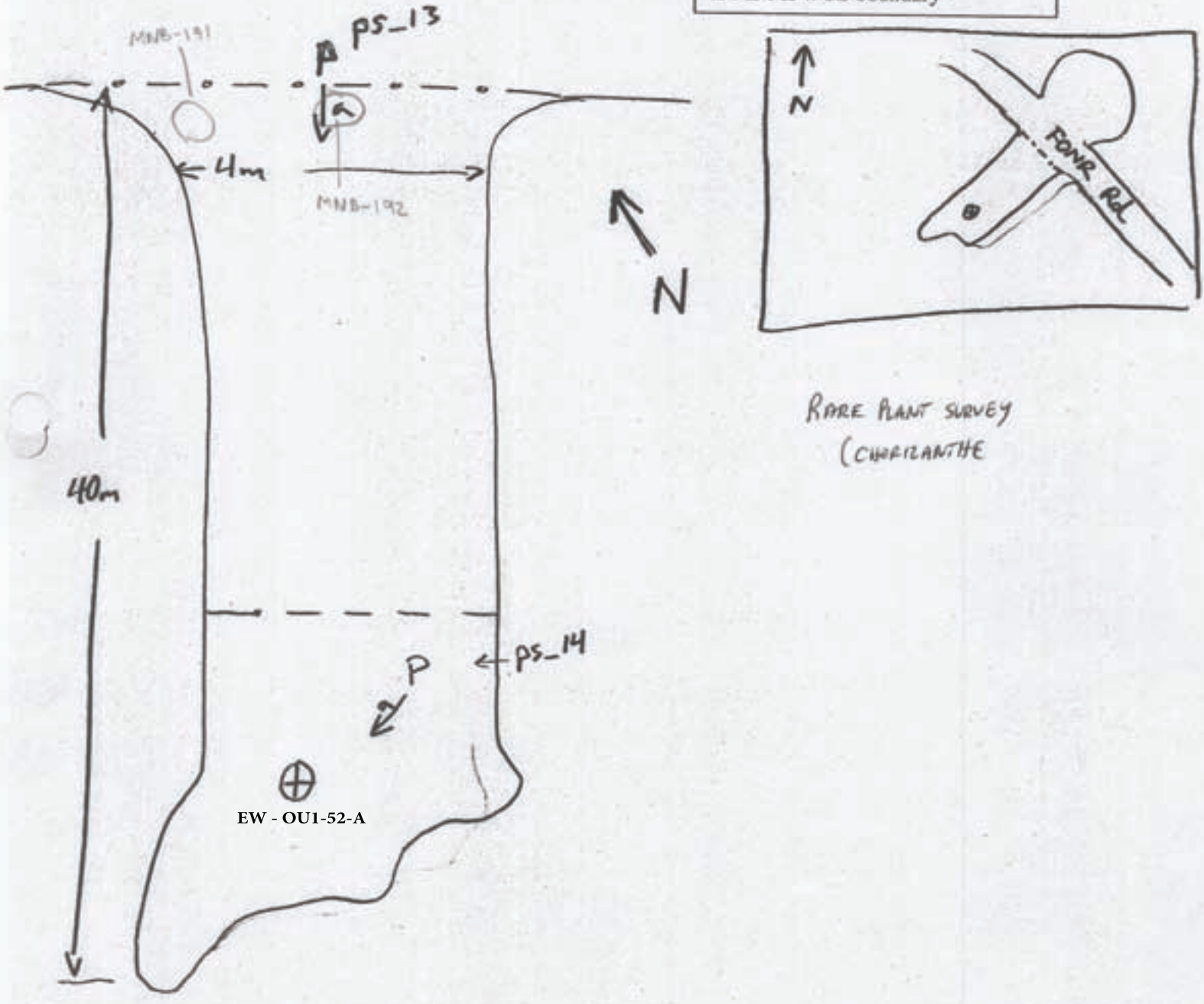
tal Aprox. Area 164 (m^2)

ell Rd. Area 120 (m^2)

Well Site Area 44 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - .	WCS boundary



Well ID: MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A#

Date 4/18/12

WCS Sub Group 9A

Surveyor MNB

Total Aprox. Area 369 (m²)

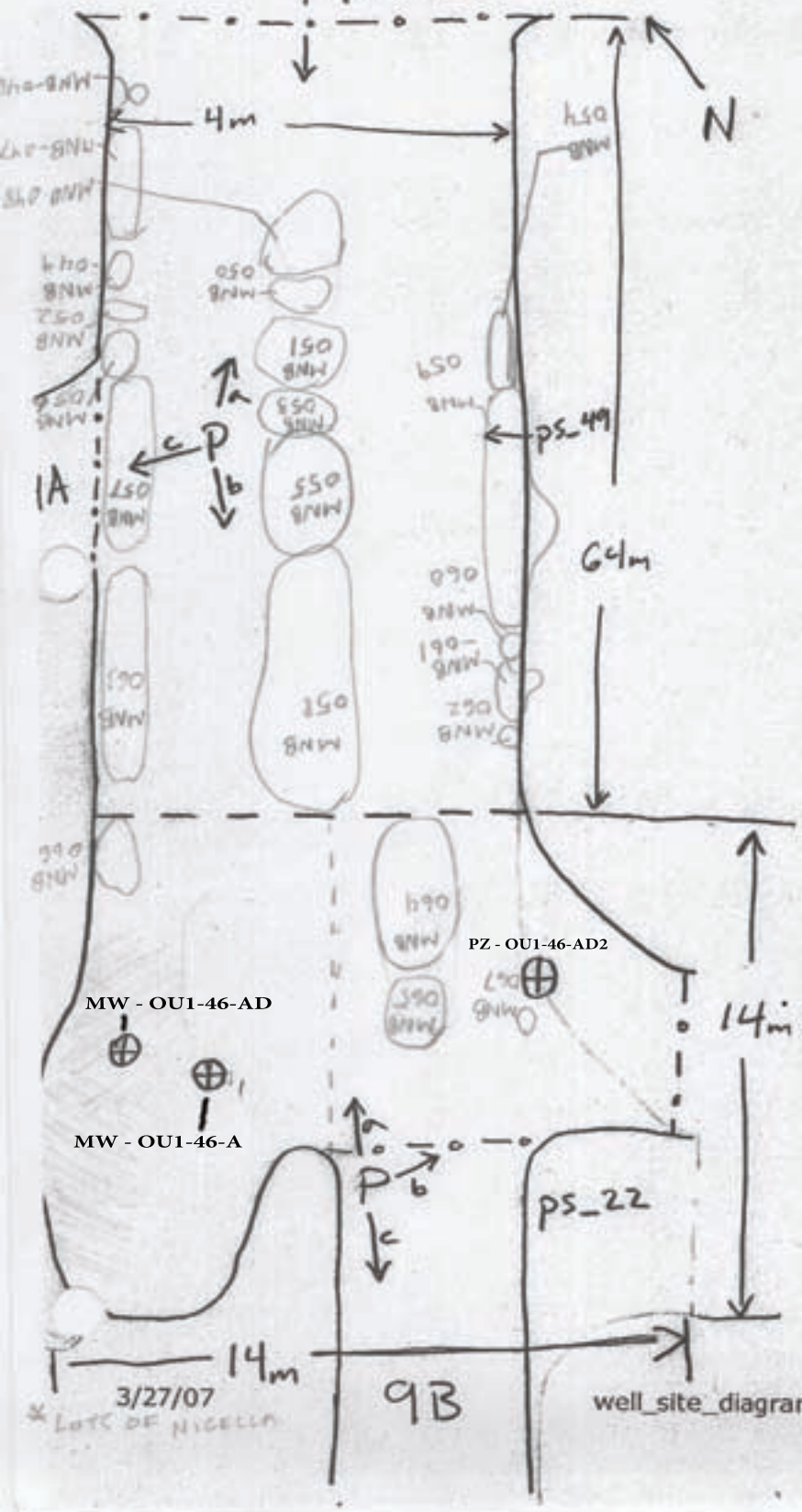
Well Rd. Area 256 (m²)

Well Site Area 113 (m²)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary

RARE PLANT SURVEY (CORIZANTHE)



Well ID: MW-OU1-84A

WCS Sub Group 9B

Total Aprox. Area 304 (m^2)

Well Rd. Area 64 (m^2)

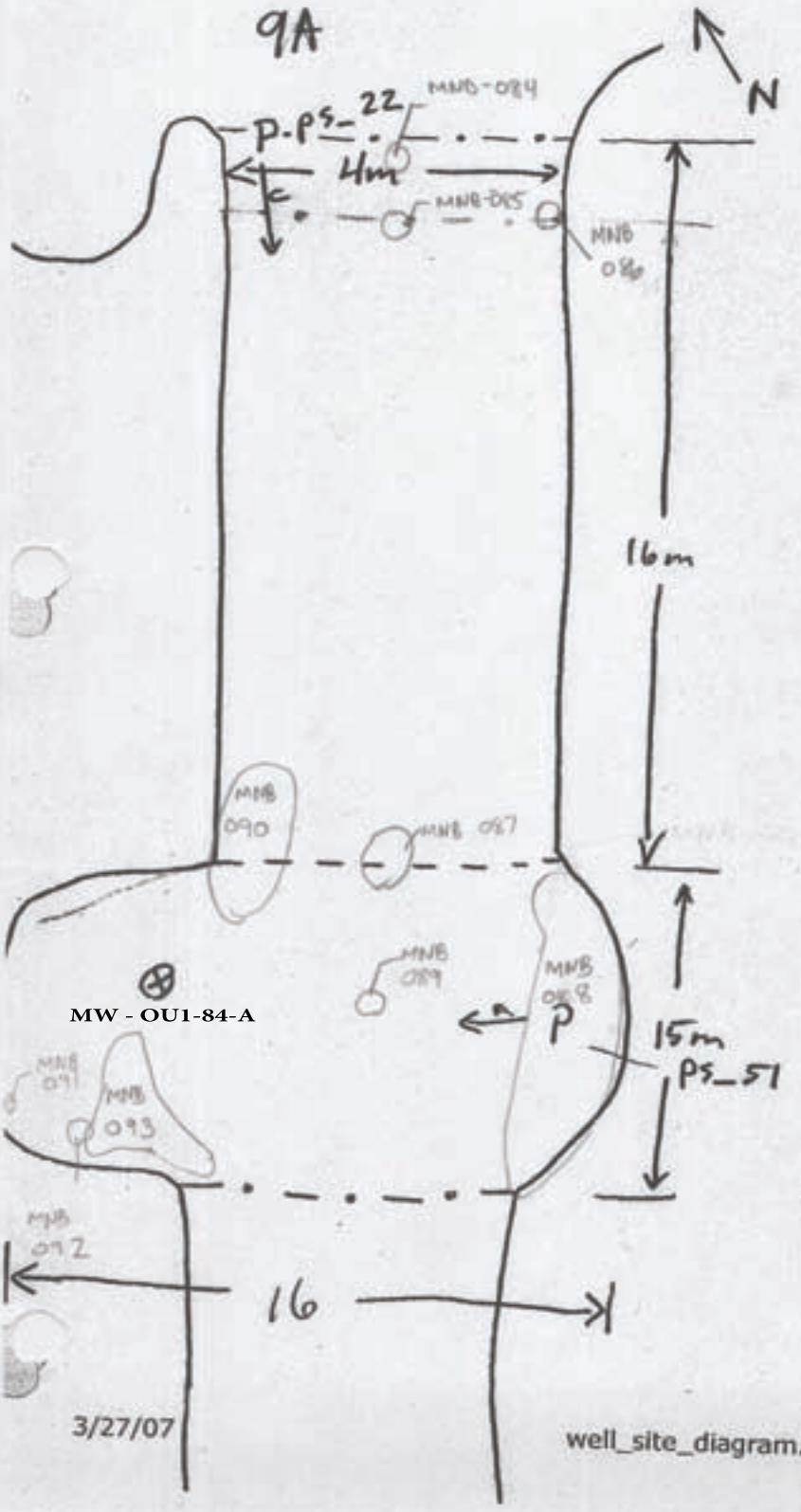
Well Site Area 240 (m^2)

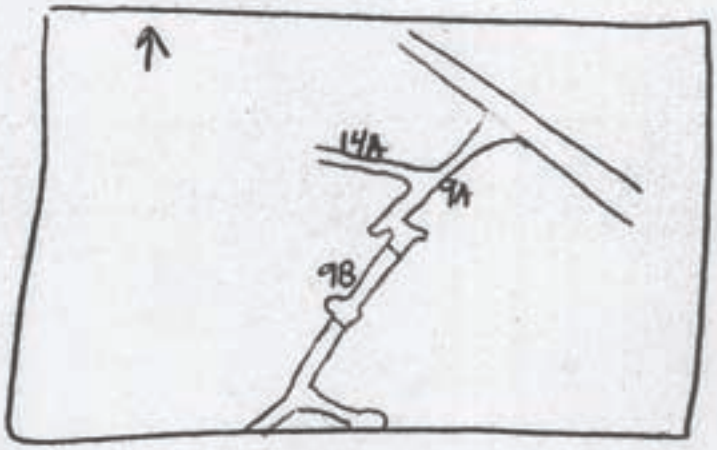
Date 4/19/12

Surveyor MNB

Legend

IA	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





* RARE PLANT SURVEY (CHORIZANTHE)

3/27/07

well_site_diagram.xls

Well ID: IW-OU1-74A

Date 4-25-12

WCS Sub Group 9C

Surveyor MNB

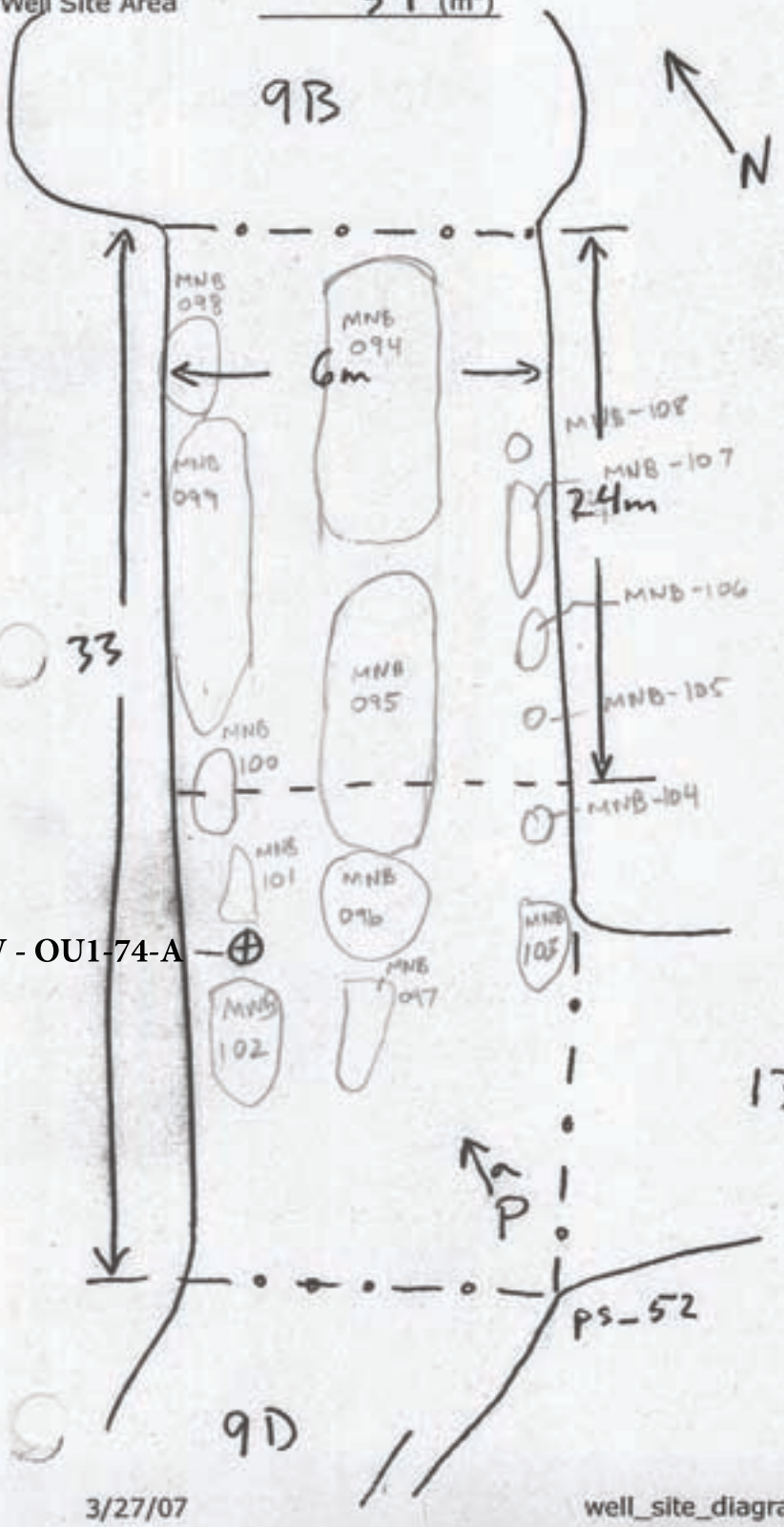
tal Aprox. Area 198 (m²)

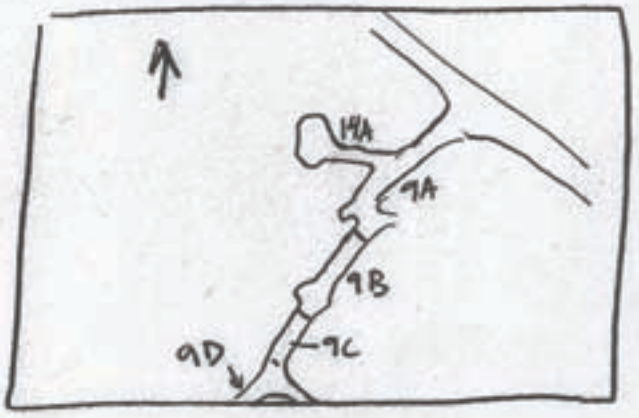
Well Rd. Area 144 (m²)

Well Site Area 54 (m²)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





RARE PLANT SURVEY
(CHORIZANTHE)

Well ID: MW-OU1-51A

WCS Sub Group 9D

Total Aprox. Area 160 (m^2)

Well Rd. Area 104 (m^2)

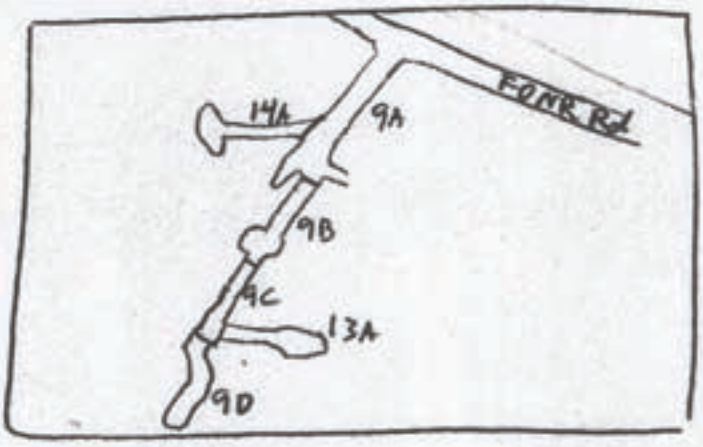
Well Site Area 56 (m^2)

Date 4-25-12

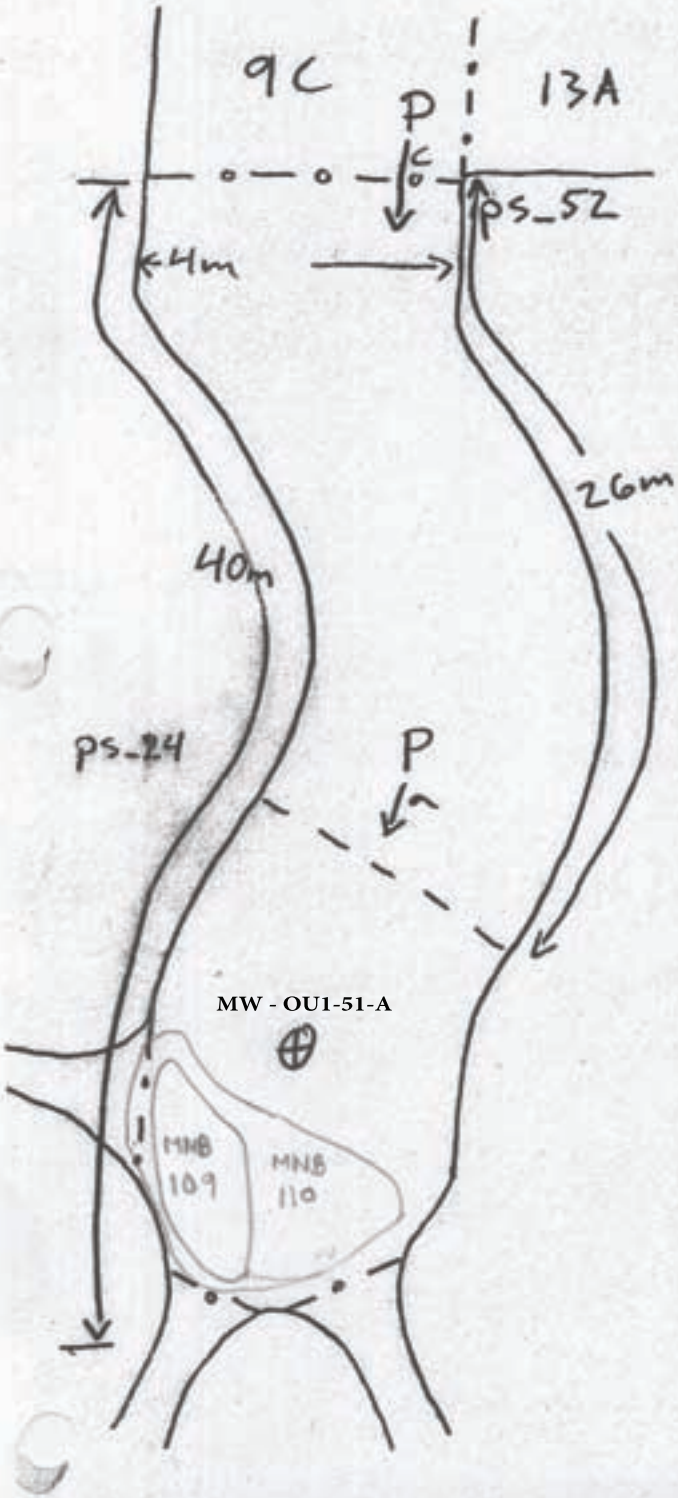
Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



RARE PLANT SURVEY
(CHORIZANTHE)



Well ID: MW-OU1-50A

WCS Sub Group 10A

Total Aprox. Area 120 (m^2)

Well Rd. Area 87 (m^2)

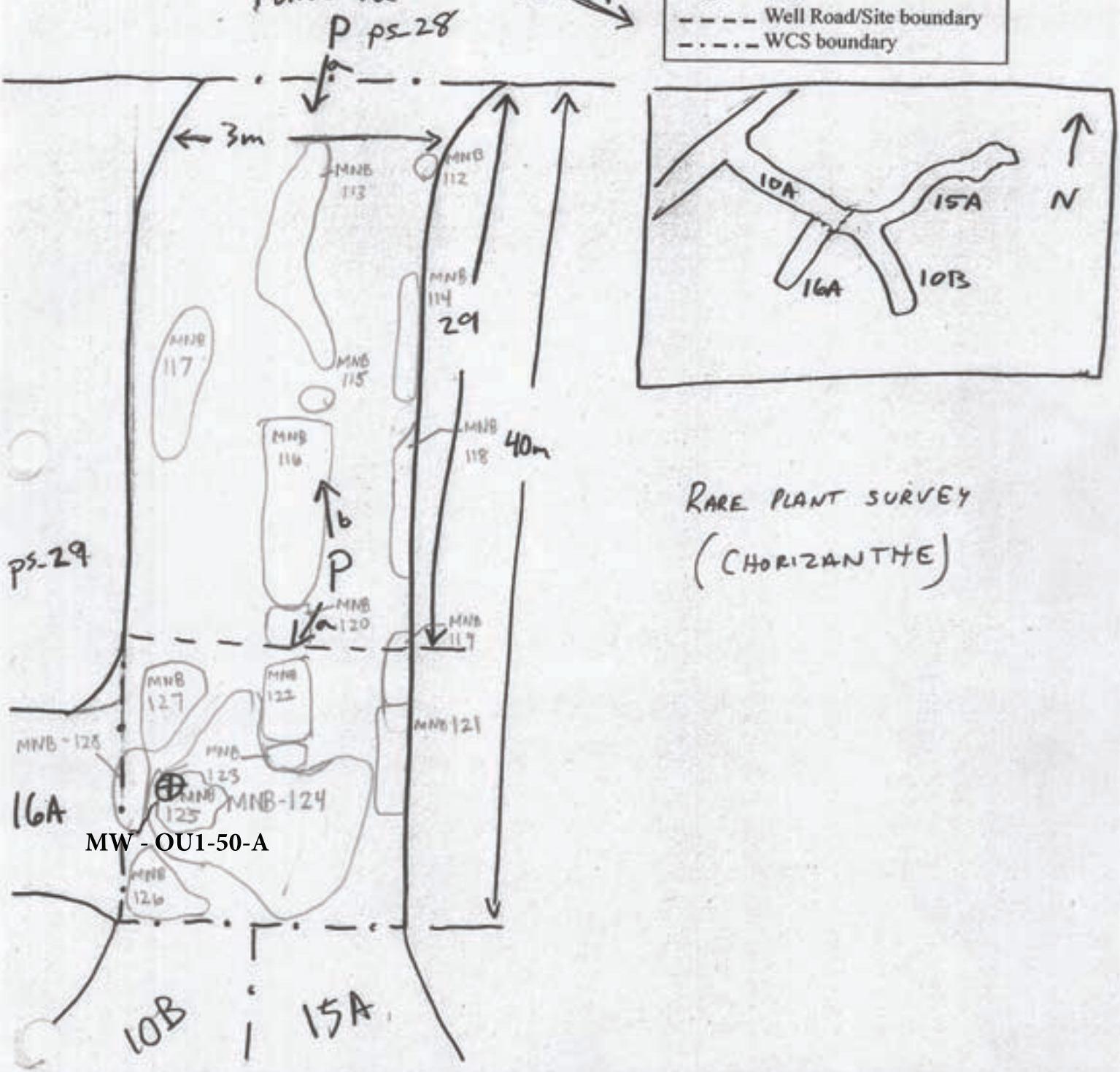
Well Site Area 33 (m^2)

Date 4/26/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



RARE PLANT SURVEY
(CHORIZANTHE)

MW - OU1-50-A

Well ID: MW-OU1-59A

Date 4/26/12

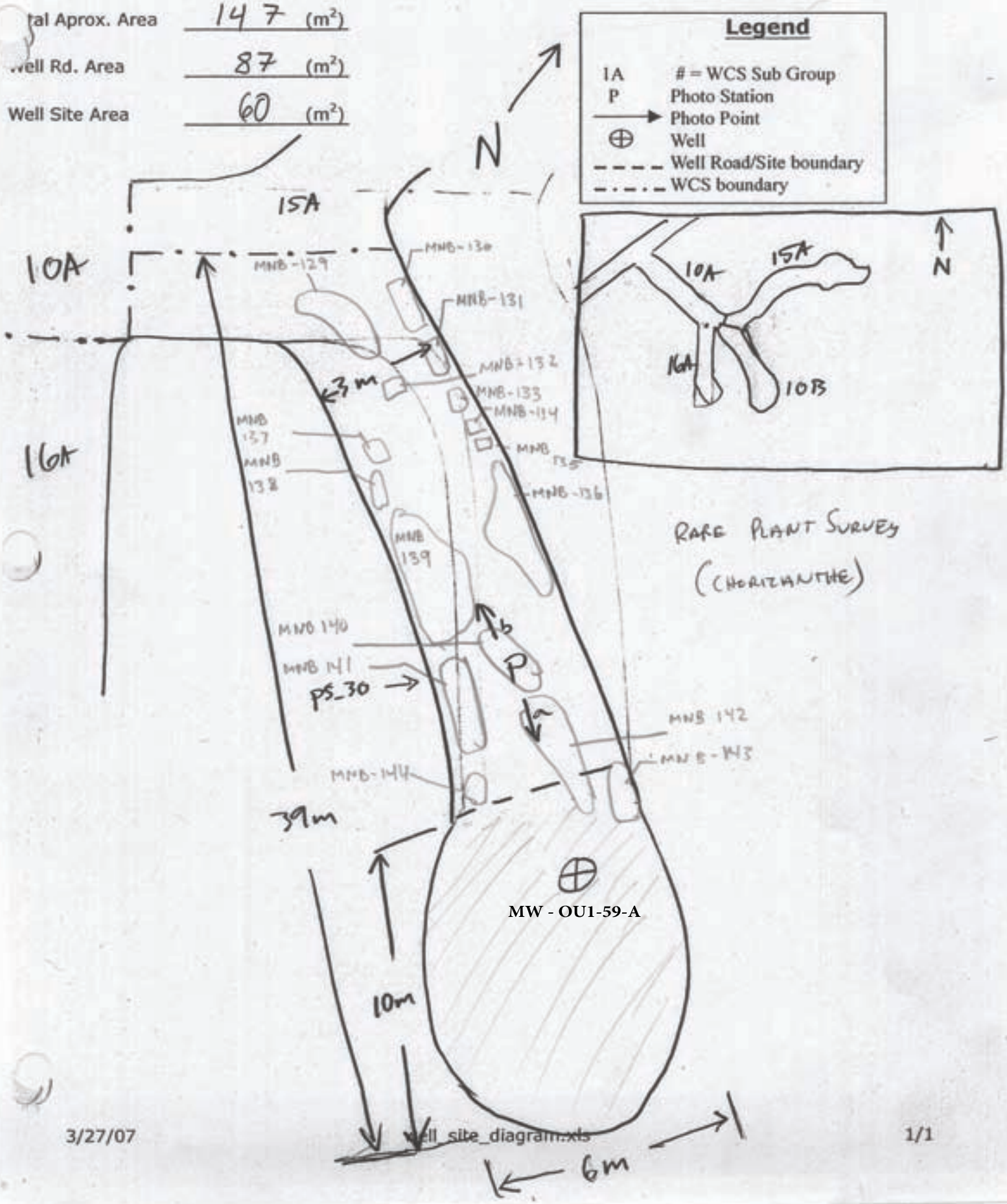
WCS Sub Group 10B

Surveyor MNB

tal Aprox. Area 147 (m^2)

ell Rd. Area 87 (m^2)

Well Site Area 60 (m^2)



Well ID: EW-OU1-71A

WCS Sub Group: 11A

Date: 5/24/12

Surveyor: MNB

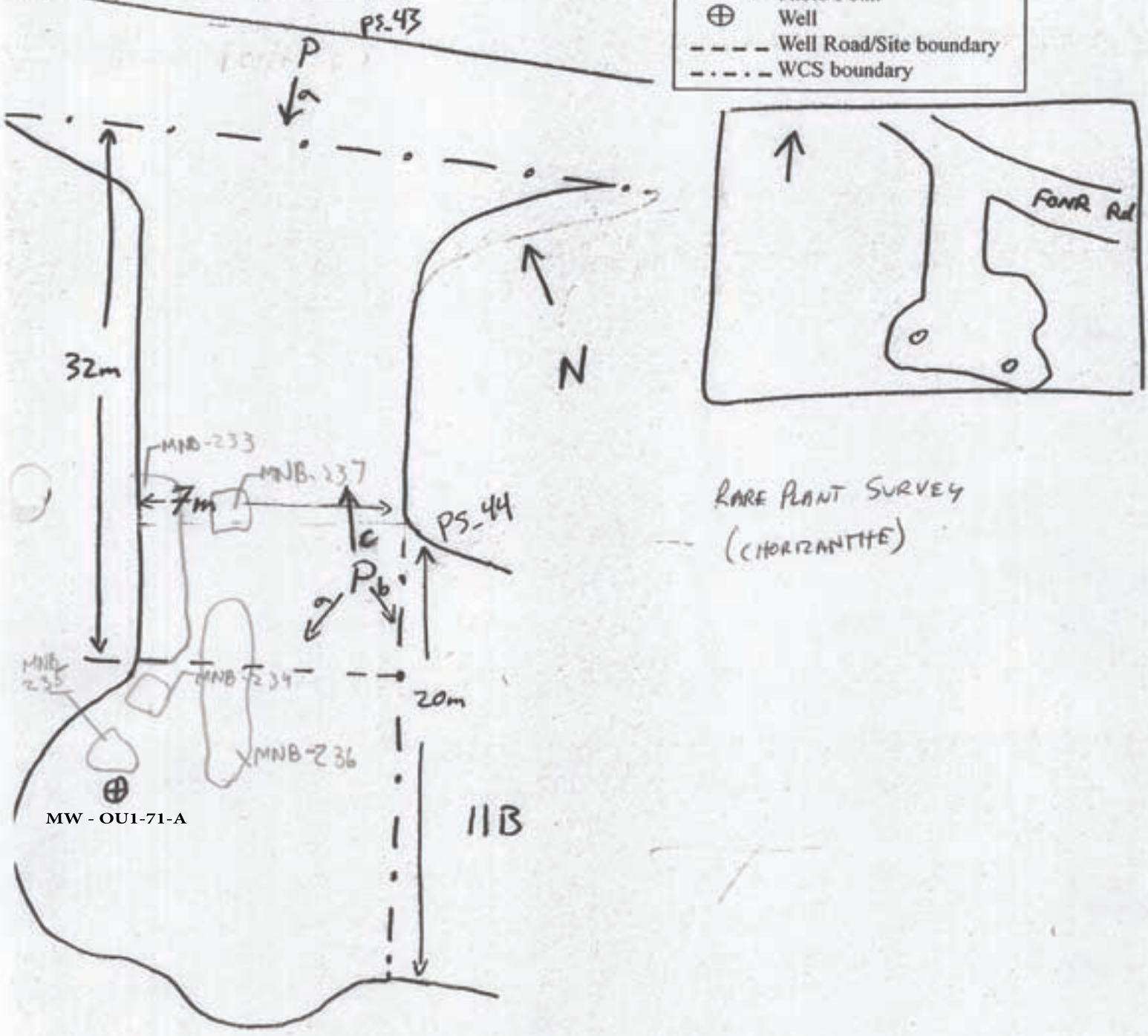
tal Aprox. Area: 329 (m^2)

ell Rd. Area: 224 (m^2)

Well Site Area: 105 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



RARE PLANT SURVEY (CHORIZANTHE)

Well ID: MW-OU1-85-A

WCS Sub Group 12B

tal Aprox. Area 164 (m^2)

ell Rd. Area 76 (m^2)

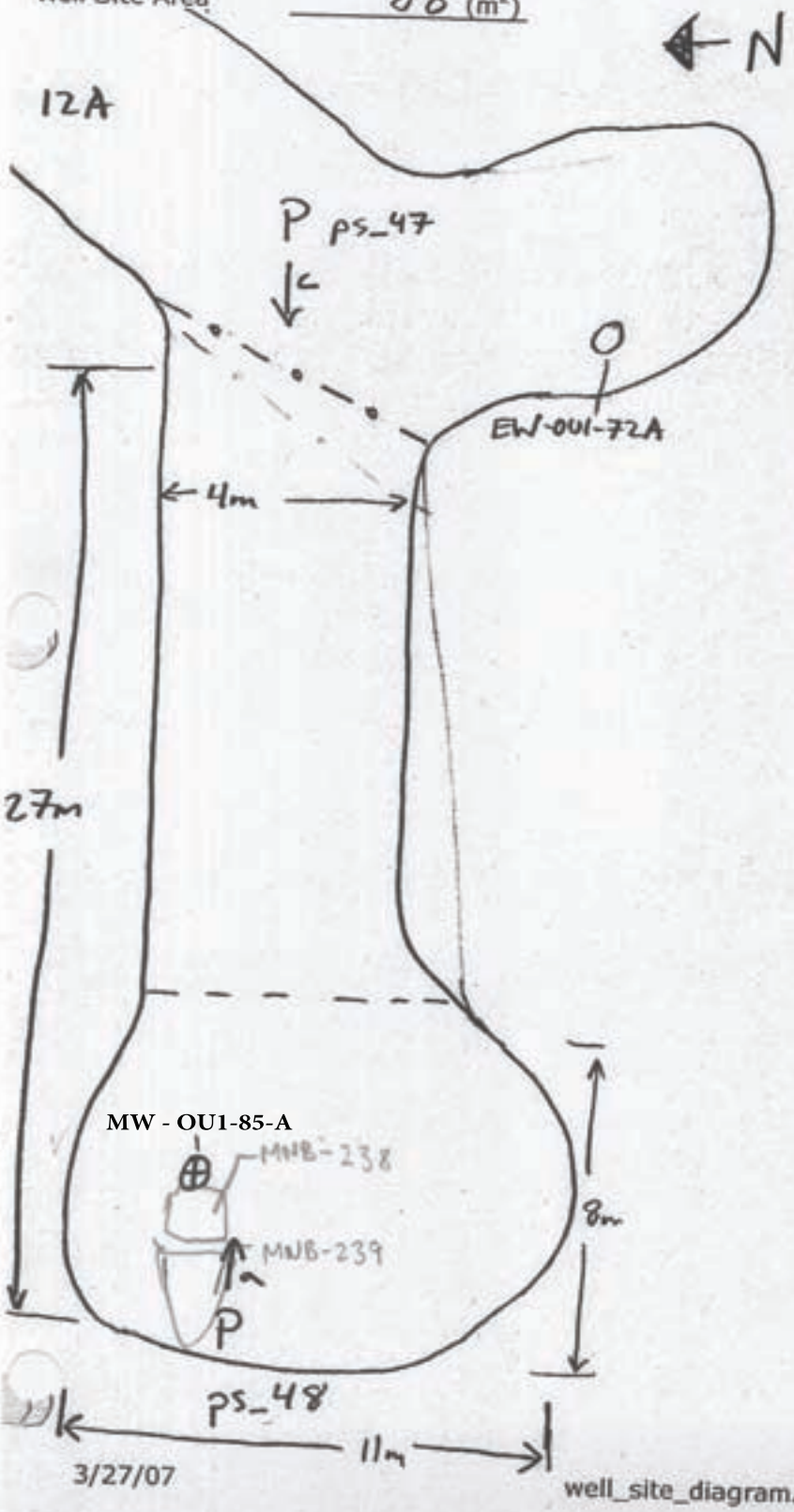
Well Site Area 88 (m^2)

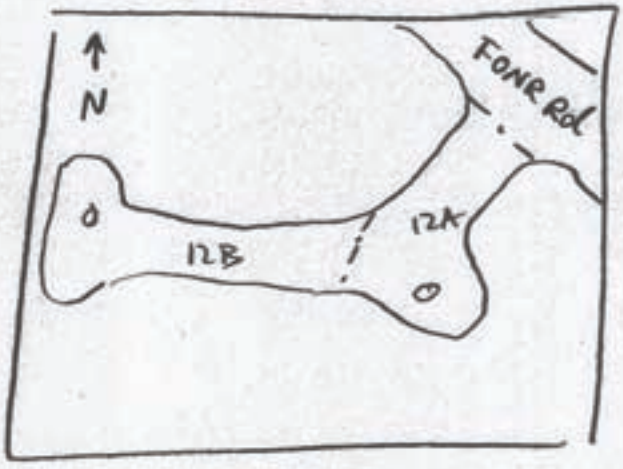
Date 5/24/12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - .	WCS boundary





RARE PLANT SURVEY
CHORIZANTHE

3/27/07

well_site_diagram.xls

Well ID: IW-OU1-73A

WCS Sub Group 13A

Date 4/25/12

Surveyor MNB

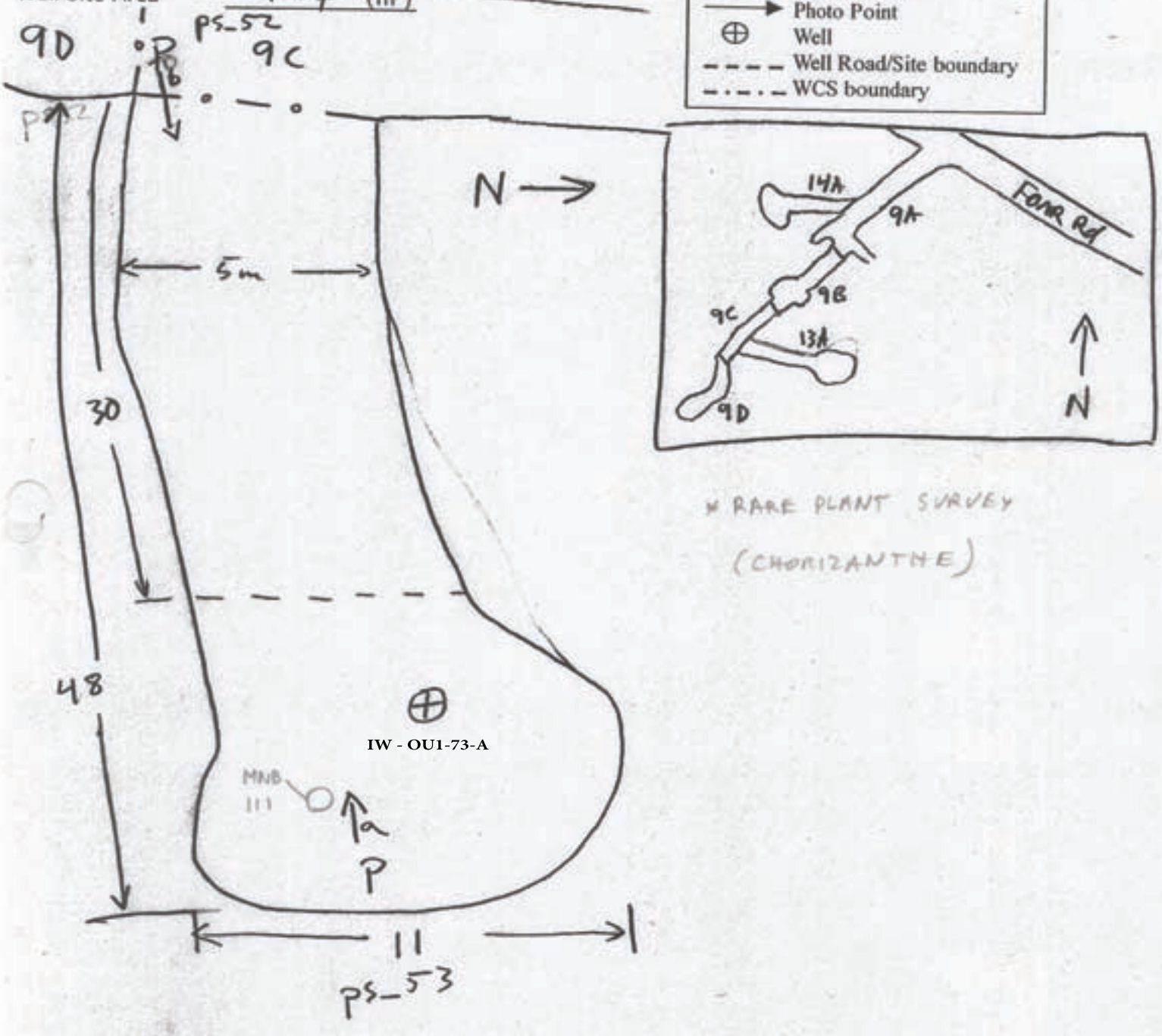
al Aprox. Area 277 (m²)

ell Rd. Area 150 (m²)

Well Site Area 127 (m²)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



* RARE PLANT SURVEY

(CHORIZANTHE)

3/27/07 well_site_diagram.xls 1/1

Well ID: MW-OU1-83A

Date 4/18/12

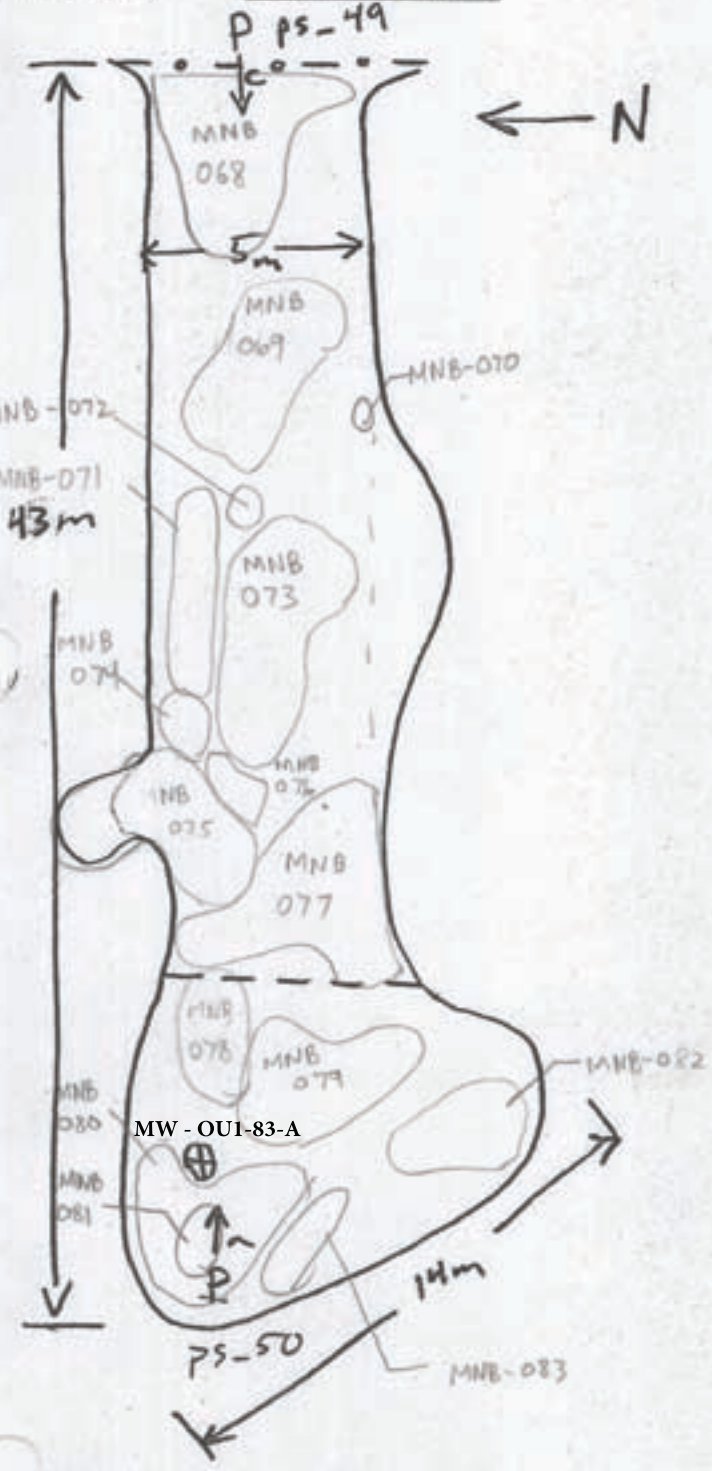
WCS Sub Group 14A

Surveyor MNB

tal Aprox. Area 327 (m^2)

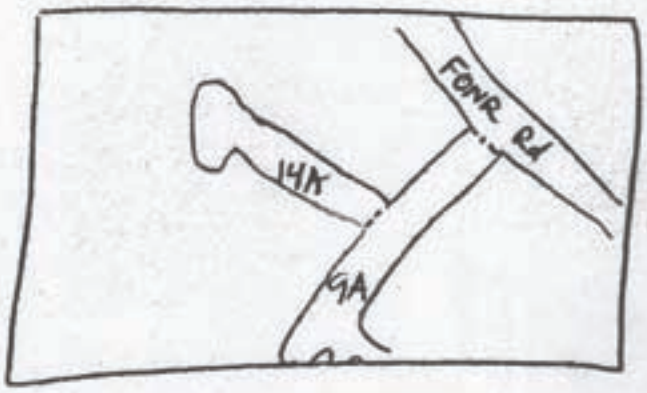
ell Rd. Area 215 (m^2)

Well Site Area 112 (m^2)



Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



RARE PLANT SURVEY
(CORIZANTHE)

Well ID: MW-OU1-82A

Date 5-16-12

WCS Sub Group 15A

Surveyor MNB

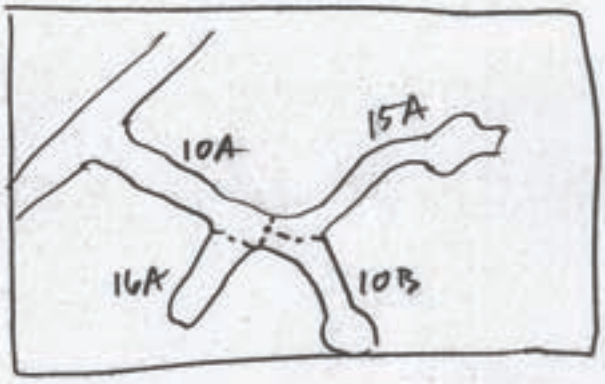
tal Aprox. Area 326 (m^2)

ell Rd. Area 208 (m^2)

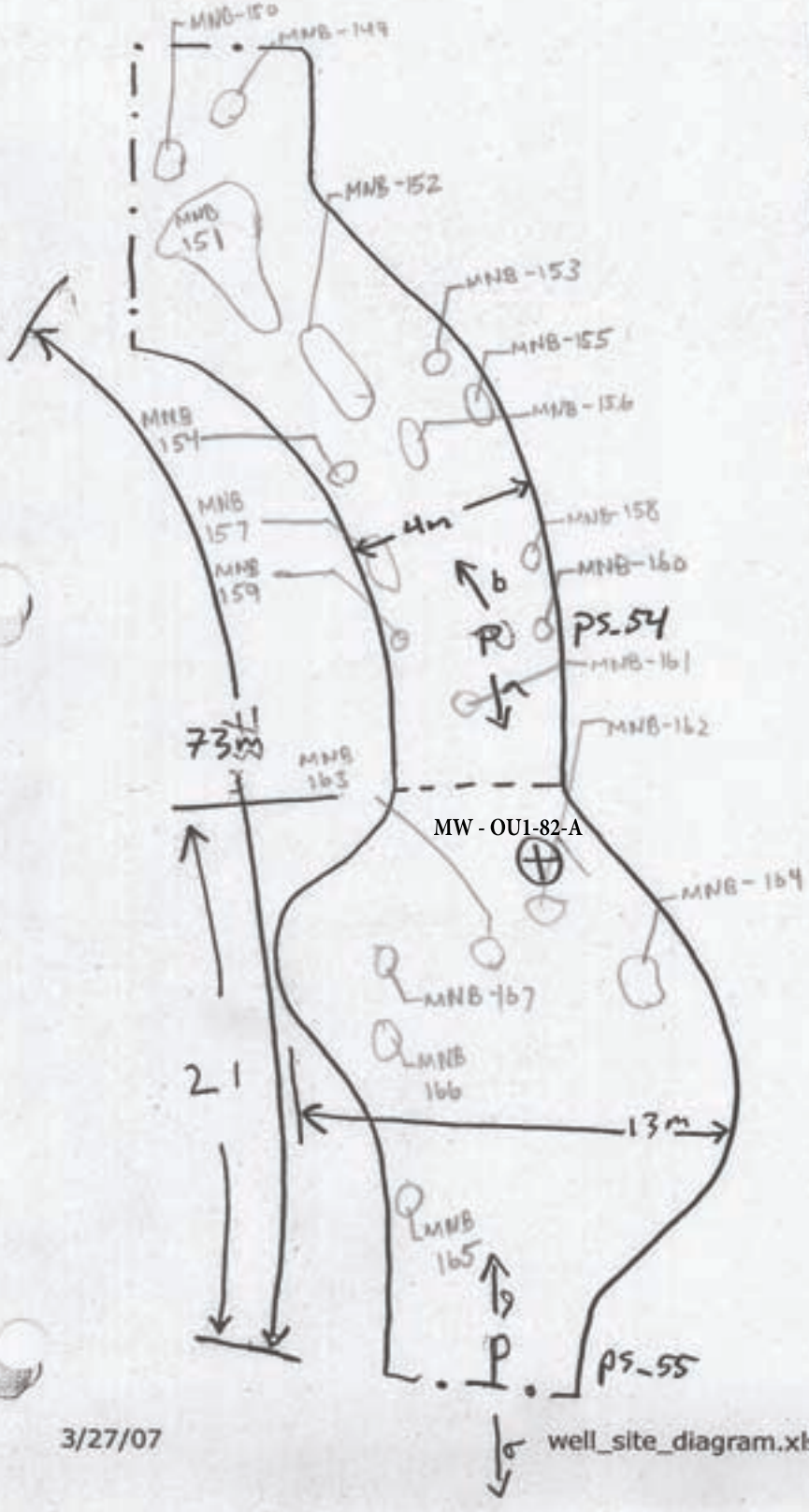
Well Site Area 118 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



RARE PLANT SURVEY (CHORIZANTHE)



Well ID: SB-OU1-2004-K

WCS Sub Group 16A

tal Aprox. Area 300 (m^2)

ell Rd. Area 160 (m^2)

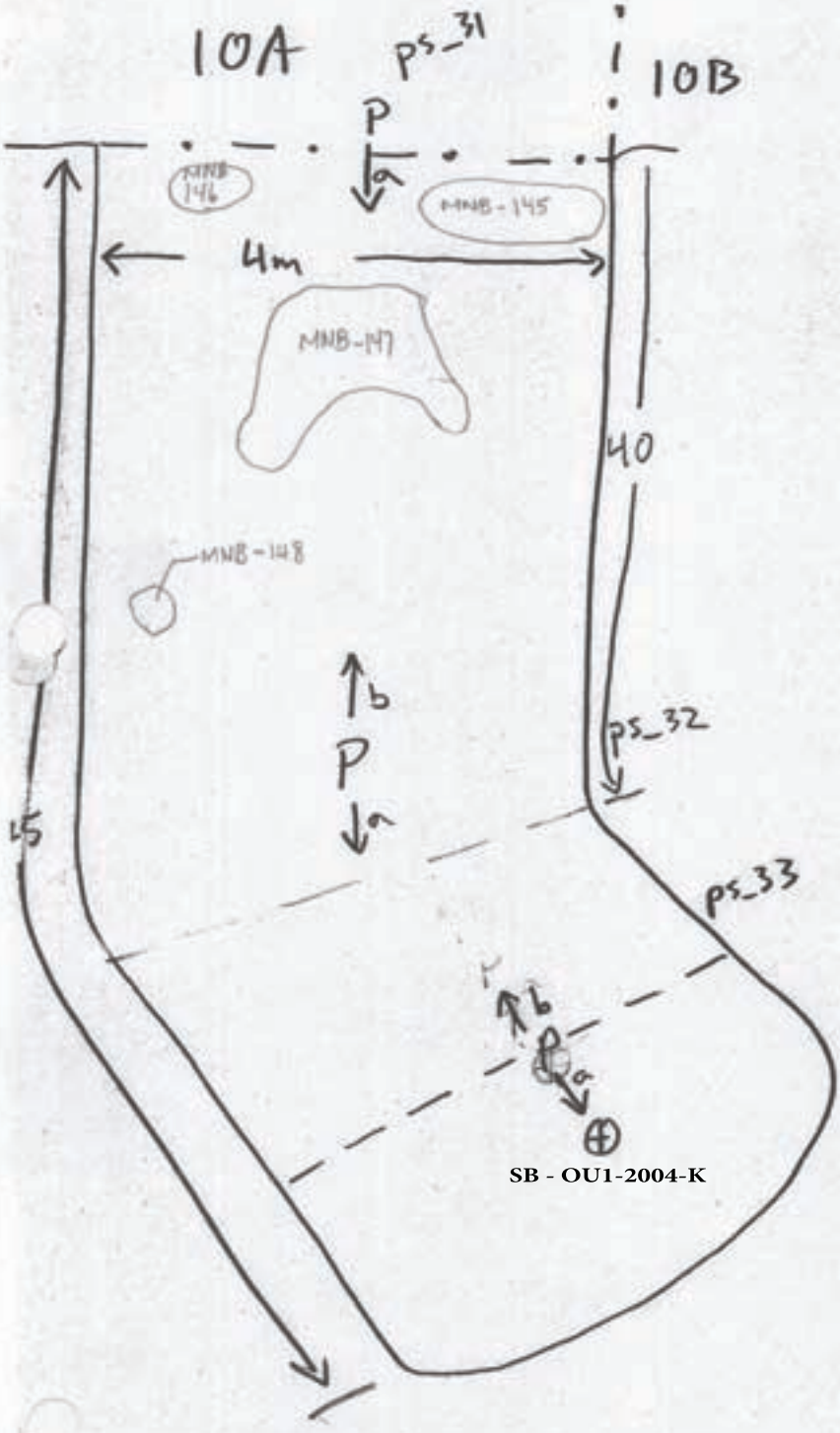
Well Site Area 140 (m^2)

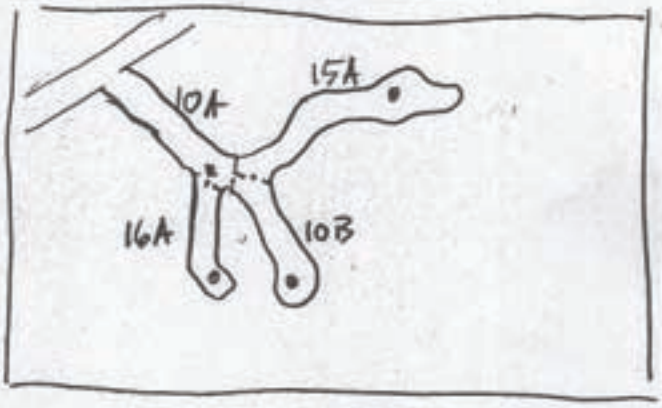
Date 5-16-12

Surveyor MNB

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





RARE PLANT SURVEY (CHORIZANTHE)

SB - OU1-2004-K

Attachment 4

‘WCS Photo Log 2012’

The attached spreadsheet (HGL_WCS_PhotoLog_2012.xls) contains a detailed log of all photographs (pre- and post-treatment) taken during the 2012 weed control program within the Operable Unit 1 portion of the FONR.

HGL - WCS 2012 - Photo Log

Date= photo treatment date
WCS= Weed Control Segment; HGL defined weed management area with corresponding wells.

Photo filenames:
All filenames given in following format: <fonr_ps_##x_year-mo-date>
where: ps= photo station ; ##= number; x= photo point; year= year four digit format (e.g., 2012);
mo= month (e.g., april=04); date= date (09 instead of 9); Photo dates are not always the same as treatment dates

Date	Photo #	WCS #	Photo Station	Photo Point	Compass Bearing Point	Well/Road #	Notes
3/29/2012	783	01A	82	a	330	N/A - Staging Area	Pre-Treatment Photos. Bad compass bearing?
3/29/2012	785	01A	83	a	116	N/A - Staging Area	Pre-Treatment Photos. Bad compass bearing?
3/29/2012	786	01A	83	b	301	N/A - Staging Area	Pre-Treatment Photos. Bad compass bearing?
3/29/2012	787	01A	84	a	103	N/A - Staging Area	Pre-Treatment Photos. Bad compass bearing?
3/29/2012	800	02A	85	a	100	N/A - Staging Area	Pre-Treatment Photos
3/29/2012	801	02A	85	b	250	N/A - Staging Area	Pre-Treatment Photos
3/29/2012	802	02A	86	a	67	N/A - Staging Area	Pre-Treatment Photos
3/29/2012	803	02A	86	b	170	N/A - Staging Area	Pre-Treatment Photos
4/4/2012	804	03A	87	a	10	N/A - Staging Area	Pre-Treatment Photos
4/4/2012	805	04A	2	a	55	IW-OU1-05-A	Pre-Treatment Photos
4/4/2012	807	04A	3	a	55	IW-OU1-05-A	Pre-Treatment Photos
4/4/2012	808	04A	3	b	236	IW-OU1-05-A	Pre-Treatment Photos
4/4/2012	809	05A	7	a	197	IW-OU1-01-A	Pre-Treatment Photos
4/4/2012	810	05A	7	b	3	IW-OU1-01-A	Pre-Treatment Photos
4/4/2012	811	05A	8	a	11	IW-OU1-01-A	Pre-Treatment Photos
4/4/2012	812	05A	8	b	40	IW-OU1-01-A	Pre-Treatment Photos
4/4/2012	813	05A	8	c	160	IW-OU1-01-A	Pre-Treatment Photos
4/4/2012	814	06A	10	a	177	EW-OU1-53-A	Pre-Treatment Photos
4/4/2012	815	06A	11	a	0	EW-OU1-53-A	Pre-Treatment Photos
4/4/2012	816	06A	11	b	244	EW-OU1-53-A	Pre-Treatment Photos
4/4/2012	817	06A	12	a	268	EW-OU1-53-A	Pre-Treatment Photos
4/4/2012	818	06A	12	b	228	EW-OU1-53-A	Pre-Treatment Photos
4/4/2012	819	07A	13	a	222	EW-OU1-52-A	Pre-Treatment Photos
4/4/2012	820	07A	14	a	245	EW-OU1-52-A	Pre-Treatment Photos
4/4/2012	823	08A	17	a	120	PZ-OU1-10-A1, IW-OU1-10A	Pre-Treatment Photos
4/4/2012	824	08A	17	b	350	PZ-OU1-10-A1, IW-OU1-10A	Pre-Treatment Photos
4/4/2012	825	08A	18	a	165	PZ-OU1-10-A1, IW-OU1-10A	Pre-Treatment Photos
4/5/2012	843	09A	22	a	27	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos
4/5/2012	844	09A	22	b	116	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos
4/5/2012	839	09A	25	a	223	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos

HGL - WCS 2012 - Photo Log

4/5/2012	840	09A	49	a	35	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos
4/5/2012	841	09A	49	b	214	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos
4/5/2012	845	09B	22	c	193	MW-OU1-84A	Pre-Treatment Photos
4/5/2012	846	09B	51	a	283	MW-OU1-84A	Pre-Treatment Photos
4/5/2012	848	09C	52	a	338	IW-OU1-74A	Pre-Treatment Photos
4/5/2012	852	09D	24	a	217	MW-OU1-51A	Pre-Treatment Photos
4/5/2012	851	09D	52	c	214	MW-OU1-51A	Pre-Treatment Photos
4/5/2012	856	10A	28	a	118	MW-OU1-50A	Pre-Treatment Photos
4/5/2012	857	10A	29	a	109	MW-OU1-50A	Pre-Treatment Photos
4/5/2012	858	10A	29	b	288	MW-OU1-50A	Pre-Treatment Photos
4/5/2012	859	10B	30	a	150	MW-OU1-59A	Pre-Treatment Photos
4/5/2012	860	10B	30	b	334	MW-OU1-59A	Pre-Treatment Photos
4/5/2012	828	11A	43	a	218	EW-OU1-71A	Pre-Treatment Photos
4/5/2012	829	11A	44	a	243	EW-OU1-71A	Pre-Treatment Photos
4/5/2012	830	11A	44	b	170	EW-OU1-71A	Pre-Treatment Photos
4/5/2012	831	11A	44	c	18	EW-OU1-71A	Pre-Treatment Photos
4/5/2012	832	11B	45	a	358	MW-OU1-86A	Pre-Treatment Photos
4/5/2012	833	12A	46	a	248	EW-OU1-72A	Pre-Treatment Photos
4/5/2012	834	12A	47	a	52	EW-OU1-72A	Pre-Treatment Photos
4/5/2012	835	12A	47	b	138	EW-OU1-72A	Pre-Treatment Photos
4/5/2012	836	12B	47	c	288	EW-OU1-72A	Pre-Treatment Photos
4/5/2012	838	12B	48	a	106	MW-OU1-85A	Pre-Treatment Photos
4/5/2012	849	13A	52	b	99	IW-OU1-73A	Pre-Treatment Photos
4/5/2012	853	13A	53	a	301	IW-OU1-73A	Pre-Treatment Photos
4/5/2012	842	14A	49	c	297	MW-OU1-83A	Pre-Treatment Photos
4/5/2012	854	14A	50	a	111	MW-OU1-83A	Pre-Treatment Photos
4/5/2012	861	15A	54	a	79	MW-OU1-82A	Pre-Treatment Photos
4/5/2012	862	15A	54	b	258	MW-OU1-82A	Pre-Treatment Photos
4/5/2012	863	15A	55	a	269	MW-OU1-82A	Pre-Treatment Photos
4/5/2012	864	15A	55	b	80	MW-OU1-82A	Pre-Treatment Photos
4/5/2012	865	16A	31	a	180	SB-OU1-2004K	Pre-Treatment Photos
4/5/2012	866	16A	32	a	150	SB-OU1-2004K	Pre-Treatment Photos
4/5/2012	867	16A	32	b	357	SB-OU1-2004K	Pre-Treatment Photos
4/5/2012	868	16A	33	a	152	SB-OU1-2004K	Pre-Treatment Photos
4/5/2012	869	16A	33	b	337	SB-OU1-2004K	Pre-Treatment Photos
4/4/2012	821	17A	15	a	122	IW-OU1-02-A	Pre-Treatment Photos
4/4/2012	822	17A	16	a	142	IW-OU1-02-A	Pre-Treatment Photos
4/4/2012	826	18A	41	a	204	MW-OU1-88-A	Pre-Treatment Photos
4/4/2012	827	18A	42	a	22	MW-OU1-88-A	Pre-Treatment Photos
7/17/2012	1122	01A	82	a	307	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1123	01A	83	a	116	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1124	01A	83	b	301	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1125	01A	84	a	103	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1126	02A	85	a	100	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1127	02A	85	b	250	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1128	02A	86	a	67	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1129	02A	86	b	240	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1131	03A	87	a	10	N/A - Staging Area	Post-Treatment Photos
7/17/2012	1132	04A	2	a	55	IW-OU1-05-A	Post-Treatment Photos
7/17/2012	1134	04A	3	a	55	IW-OU1-05-A	Post-Treatment Photos
7/17/2012	1135	04A	3	b	236	IW-OU1-05-A	Post-Treatment Photos

HGL - WCS 2012 - Photo Log

7/17/2012	1136	05A	7	a	197	IW-OU1-01-A	Post-Treatment Photos
7/17/2012	1137	05A	7	b	3	IW-OU1-01-A	Post-Treatment Photos
7/17/2012	1138	05A	8	a	11	IW-OU1-01-A	Post-Treatment Photos
7/17/2012	1139	05A	8	b	40	IW-OU1-01-A	Post-Treatment Photos
7/17/2012	1140	05A	8	c	160	IW-OU1-01-A	Post-Treatment Photos
7/17/2012	1141	06A	10	a	177	EW-OU1-53-A	Post-Treatment Photos
7/17/2012	1142	06A	11	a	0	EW-OU1-53-A	Post-Treatment Photos
7/17/2012	1143	06A	11	b	244	EW-OU1-53-A	Post-Treatment Photos
7/17/2012	1144	06A	12	a	268	EW-OU1-53-A	Post-Treatment Photos
7/17/2012	1145	06A	12	b	228	EW-OU1-53-A	Post-Treatment Photos
7/17/2012	1146	07A	13	a	222	EW-OU1-52-A	Post-Treatment Photos
7/17/2012	1147	07A	14	a	245	EW-OU1-52-A	Post-Treatment Photos
7/17/2012	1151	08A	17	a	120	PZ-OU1-10-A1, IW-OU1-10A	Post-Treatment Photos
7/17/2012	1152	08A	17	b	350	PZ-OU1-10-A1, IW-OU1-10A	Post-Treatment Photos
7/17/2012	1150	08A	18	a	165	PZ-OU1-10-A1, IW-OU1-10A	Post-Treatment Photos
7/17/2012	1170	09A	22	a	27	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/17/2012	1171	09A	22	b	116	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/17/2012	1166	09A	25	a	223	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/17/2012	1167	09A	49	a	35	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/17/2012	1168	09A	49	b	214	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/17/2012	1172	09A	22	c	193	MW-OU1-84A	Post-Treatment Photos
7/17/2012	1173	09B	51	a	283	MW-OU1-84A	Post-Treatment Photos
7/17/2012	1174	09C	52	a	338	IW-OU1-74A	Post-Treatment Photos
7/17/2012	1176	09D	24	a	217	MW-OU1-51A	Post-Treatment Photos
7/17/2012	1175	09D	52	c	214	MW-OU1-51A	Post-Treatment Photos
7/17/2012	1180	10A	28	a	118	MW-OU1-50A	Post-Treatment Photos
7/17/2012	1181	10A	29	a	109	MW-OU1-50A	Post-Treatment Photos
7/17/2012	1182	10A	29	b	288	MW-OU1-50A	Post-Treatment Photos
7/17/2012	1183	10B	30	a	150	MW-OU1-59A	Post-Treatment Photos
7/17/2012	1184	10B	30	b	334	MW-OU1-59A	Post-Treatment Photos
7/17/2012	1155	11A	43	a	218	EW-OU1-71A	Post-Treatment Photos
7/17/2012	1156	11A	44	a	243	EW-OU1-71A	Post-Treatment Photos
7/17/2012	1157	11A	44	b	170	EW-OU1-71A	Post-Treatment Photos
7/17/2012	1158	11B	44	c	18	EW-OU1-71A	Post-Treatment Photos
7/17/2012	1160	11B	45	a	358	MW-OU1-86A	Post-Treatment Photos
7/17/2012	1161	12A	46	a	248	EW-OU1-72A	Post-Treatment Photos
7/17/2012	1162	12A	47	a	52	EW-OU1-72A	Post-Treatment Photos
7/17/2012	1163	12A	47	b	138	EW-OU1-72A	Post-Treatment Photos
7/17/2012	1164	12A	47	c	288	EW-OU1-72A	Post-Treatment Photos
7/17/2012	1165	12B	48	a	108	MW-OU1-85A	Post-Treatment Photos
7/17/2012	1177	13A	52	b	99	IW-OU1-73A	Post-Treatment Photos
7/17/2012	1178	13A	53	a	301	IW-OU1-73A	Post-Treatment Photos

HGL - WCS 2012 - Photo Log

7/17/2012	1169	14A	49	c	297	MW-OU1-83A	Post-Treatment Photos
7/17/2012	1179	14A	50	a	111	MW-OU1-83A	Post-Treatment Photos
7/17/2012	1185	15A	54	a	79	MW-OU1-82A	Post-Treatment Photos
7/17/2012	1186	15A	54	b	258	MW-OU1-82A	Post-Treatment Photos
7/17/2012	1187	15A	55	a	269	MW-OU1-82A	Post-Treatment Photos
7/17/2012	1188	15A	55	b	80	MW-OU1-82A	Post-Treatment Photos
7/17/2012	1189	16A	31	a	180	SB-OU1-2004K	Post-Treatment Photos
7/17/2012	1190	16A	32	a	150	SB-OU1-2004K	Post-Treatment Photos
7/17/2012	1191	16A	32	b	357	SB-OU1-2004K	Post-Treatment Photos
7/17/2012	1192	16A	33	a	152	SB-OU1-2004K	Post-Treatment Photos
7/19/2012	1253	16A	33	b	337	SB-OU1-2004K	Post-Treatment Photos
7/17/2012	1148	17A	15	a	122	IW-OU1-02-A	Post-Treatment Photos
7/17/2012	1149	17A	16	a	142	IW-OU1-02-A	Post-Treatment Photos
7/17/2012	1153	18A	41	a	204	MW-OU1-88-A	Post-Treatment Photos
7/17/2012	1154	18A	42	a	22	MW-OU1-88-A	Post-Treatment Photos

Attachment 5

‘HGL_WCS_Photos_2012’

The enclosed compact disc (CD) contains digital photographs taken during the 2012 weed control program performed by FONR staff. Photographs on the CD are organized in the folder 'HGL_WCS_Photos_2012_jpgs'. This folder contains photo files (.jpg format) with the file name designating the reserve (fonr), the photo station number (‘_ps#’), and the date the photo was taken (_year-month-day).

e.g. ‘fonr_ps13a_2012-04-04’
‘fonr_ps13a_2012-07-17’

Each photo station has at least two photos, one pre-treatment and one post-treatment, designated by date of photo. Refer to photo log (HGL_WCS_PhotoLog_2012.xls) for more detailed information.

In addition to the digital photograph files, the enclosed CD also contains an Adobe PDF file 'HGL_WCS_Photos_2012.pdf' with the pre-treatment and post-treatment photos for each WCS labeled and formatted on a standard letter (8.5" x 11") portrait layout.

WCS# 1A ps82a Staging Area Pre-Treatment 29 March 2012

WCS# 1A ps82a Staging Area Post-Treatment 17 July 2012

WCS# 1A ps83a Staging Area Pre-Treatment 29 March 2012

WCS# 1A ps83a Staging Area Post-Treatment 17 July 2012

WCS# 1A ps84a Staging Area Pre-Treatment 29 March 2012

WCS# 1A ps84a Staging Area Post-Treatment 17 July 2012

WCS# 2A ps85a Staging Area Pre-Treatment 29 March 2012

WCS# 2A ps85a Staging Area Post-Treatment 17 July3 2012

WCS# 2A ps85b Staging Area Pre-Treatment 29 March 2012

WCS# 2A ps85b Staging Area Post-Treatment 17 July 2012

WCS# 2A ps86a Staging Area Pre-Treatment 29 March 2012

WCS# 2A ps86a Staging Area Post-Treatment 17 July 2012

WCS# 2A ps86b Staging Area Pre-Treatment 29 March 2012

WCS# 2A ps86b Staging Area Post-Treatment 17 July 2012

WCS# 3A ps87a Staging Area Pre-Treatment 4 April 2012

WCS# 3A ps87a Staging Area Post-Treatment 17 July 2012

WCS# 4A ps2a IW-OU1-05-A Pre-Treatment 4 April 2012

WCS# 4A ps2a IW-OU1-05-A Post-Treatment 17 July 2012

WCS# 4A ps3a IW-OU1-05-A Pre-Treatment 4 April 2012

WCS# 4A ps3a IW-OU1-05-A Post-Treatment 17 July 2012

WCS# 4A ps3b IW-OU1-05-A Pre-Treatment 4 April 2012

WCS# 4A ps3b IW-OU1-05-A Post-Treatment 17July 2012

WCS# 5A ps7a IW-OU1-01-A Pre-Treatment 4 April 2012

WCS# 5A ps7a IW-OU1-01-A Post-Treatment 17 July 2012

WCS# 5A ps7b IW-OU1-01-A Pre-Treatment 4 April 2012

WCS# 5A ps7b IW-OU1-01-A Post-Treatment 17 July 2012

WCS# 5A ps8a IW-OU1-01-A Pre-Treatment 4 April 2012

WCS# 5A ps8a IW-OU1-01-A Post-Treatment 17 July 2012

WCS# 5A ps8b IW-OU1-01-A Pre-Treatment 4 April 2012

WCS# 5A ps8b IW-OU1-01-A Post-Treatment 17 July 2012

WCS# 5A ps8c IW-OU1-01-A Pre-Treatment 4 April 2012

WCS# 5A ps8c IW-OU1-01-A Post-Treatment 17 July 2012

WCS# 6A ps10a EW-OU1-53-A Pre-Treatment 4 April 2012

WCS# 6A ps10a EW-OU1-53-A Post-Treatment 17 July 2012

WCS# 6A ps11a EW-OU1-53-A Pre-Treatment 4 April 2012

WCS# 6A ps11a EW-OU1-53-A Post-Treatment 17 July 2012

WCS# 6A ps11b EW-OU1-53-A Pre-Treatment 4 April 2012

WCS# 6A ps11b EW-OU1-53-A Post-Treatment 17 July 2012

WCS# 6A ps12a EW-OU1-53-A Pre-Treatment 4 April 2012

WCS# 6A ps12a EW-OU1-53-A Post-Treatment 17 July 2012

WCS# 6A ps12b EW-OU1-53-A Pre-Treatment 4 April 2012

WCS# 6A ps12b EW-OU1-53-A Post-Treatment 17 July 2012

WCS# 7A ps13a EW-OU1-52-A Pre-Treatment 4 April 2012

WCS# 7A ps13a EW-OU1-52-A Post-Treatment 17 July 2012

WCS# 7A ps14a EW-OU1-52-A Pre-Treatment 4 April 2012

WCS# 7A ps14a EW-OU1-52-A Post-Treatment 17 July 2012

WCS# 8A ps17a IW-OU1-10-A Pre-Treatment 4 April 2012

WCS# 8A ps17a IW-OU1-10-A Post-Treatment 17 July 2012

WCS# 8A ps17b IW-OU1-10-A Pre-Treatment 4 April 2012

WCS# 8A ps17b IW-OU1-10-A Post-Treatment 17 July 2012

WCS# 8A ps18a IW-OU1-10-A Pre-Treatment 4 April 2012

WCS# 8A ps18a IW-OU1-10-A Post-Treatment 17 July 2012

WCS# 9A ps22a MW-OU1-46-A Pre-Treatment 5 April 2012

WCS# 9A ps22a MW-OU1-46-A Post-Treatment 17 July 2012

WCS# 9A ps22b MW-OU1-46-A Pre-Treatment 5 April 2012

WCS# 9A ps22b MW-OU1-46-A Post-Treatment 17 July 2012

WCS# 9A ps25a MW-OU1-46-A Pre-Treatment 5 April 2012

WCS# 9A ps25a MW-OU1-46-A Post-Treatment 17 July 2012

WCS# 9A ps49a MW-OU1-46-A Pre-Treatment 5 April 2012

WCS# 9A ps49a MW-OU1-46-A Post-Treatment 17 July 2012

WCS# 9A ps49b MW-OU1-46-A Pre-Treatment 6 April 2012

WCS# 9A ps49b MW-OU1-46-A Post-Treatment 17 July 2012

WCS# 9A ps49c MW-OU1-46-A Pre-Treatment 5 April 2012

WCS# 9A ps49c MW-OU1-46-A Post-Treatment 17 July 2012

WCS# 9B ps22c MW-OU1-84A Pre-Treatment 5 April 2012

WCS# 9B ps22c MW-OU1-84A Post-Treatment 17 July 2012

WCS# 9B ps51a MW-OU1-84A Pre-Treatment 5 April 2012

WCS# 9B ps51a MW-OU1-84A Post-Treatment 17 July 2012

WCS# 9C ps52a IW-OU1-74A Pre-Treatment 5 April 2012

WCS# 9C ps52a IW-OU1-74A Post-Treatment 17 July 2012

WCS# 9D ps24a MW-OU1-51-A Pre-Treatment 5 April 2012

WCS# 9D ps24a MW-OU1-51-A Post-Treatment 17 July 2012

WCS# 9D ps52c MW-OU1-51-A Pre-Treatment 5 April 2012

WCS# 9D ps52c MW-OU1-51-A Post-Treatment 17 July 2012

WCS# 10A ps28a MW-OU1-50-A Pre-Treatment 5 April 2012

WCS# 10A ps28a MW-OU1-50-A Post-Treatment 17 July 2012

WCS# 10A ps29a MW-OU1-50-A Pre-Treatment 5 April 2012

WCS# 10A ps29a MW-OU1-50-A Post-Treatment 17 July 2012

WCS# 10A ps29b MW-OU1-50-A Pre-Treatment 5 April 2012

WCS# 10A ps29b MW-OU1-50-A Post-Treatment 17 July 2012

WCS# 10B ps30a MW-OU1-59-A Pre-Treatment 5 April 2012

WCS# 10B ps30a MW-OU1-59-A Post-Treatment 17 July 2012

WCS# 10B ps30b MW-OU1-59-A Pre-Treatment 5 April 2012

WCS# 10B ps30b MW-OU1-59-A Post-Treatment 17 July 2012

WCS# 11A ps43a EW-OU1-71-A Pre-Treatment 5 April 2012

WCS# 11A ps43a EW-OU1-71-A Post-Treatment 17 July 2012

WCS# 11A ps44a EW-OU1-71-A Pre-Treatment 5 April 2012

WCS# 11A ps44a EW-OU1-71-A Post-Treatment 17 July 2012

WCS# 11A ps44b EW-OU1-71-A Pre-Treatment 5 April 2012

WCS# 11A ps44b EW-OU1-71-A Post-Treatment 17 July 2012

WCS# 11A ps44c EW-OU1-71-A Pre-Treatment 5 April 2012

WCS# 11A ps44c EW-OU1-71-A Post-Treatment 17 July 2012

WCS# 11B ps45a MW-OU1-86-A Pre-Treatment 5 April 2012

WCS# 11B ps45a MW-OU1-86-A Post-Treatment 17 October 2012

WCS# 12A ps46a EW-OU1-72-A Pre-Treatment 5 April 2012

WCS# 12A ps46a EW-OU1-72-A Post-Treatment 17 July 2012

WCS# 12A ps47a EW-OU1-72-A Pre-Treatment 5 April 2012

WCS# 12A ps47a EW-OU1-72-A Post-Treatment 17 July 2012

WCS# 12A ps47b EW-OU1-72-A Pre-Treatment 5 April 2012

WCS# 12A ps47b EW-OU1-72-A Post-Treatment 17 July 2012

WCS# 12A ps47c EW-OU1-72-A Pre-Treatment 5 April 2012

WCS# 12A ps47c EW-OU1-72-A Post-Treatment 17 July 2012

WCS# 12B ps48a MW-OU1-85-A Pre-Treatment 5 April 2012

WCS# 12B ps48a MW-OU1-85-A Post-Treatment 17 July 2012

WCS# 13A ps52b IW-OU1-73A Pre-Treatment 5 April 2012

WCS# 13A ps52b IW-OU1-73A Post-Treatment 17 July 2012

WCS# 13A ps53a IW-OU1-73A Pre-Treatment 5 April 2012

WCS# 13A ps53a IW-OU1-73A Post-Treatment 17 July 2012

WCS# 14A ps49c MW-OU1-83A Pre-Treatment 5 April 2012

WCS# 14A ps49c MW-OU1-83A Post-Treatment 17 July 2012

WCS# 14A ps50a MW-OU1-83A Pre-Treatment 6 April 2012

WCS# 14A ps50a MW-OU1-83A Post-Treatment 17 July 2012

WCS# 15A ps54a MW-OU1-82A Pre-Treatment 5 April 2012

WCS# 15A ps54a MW-OU1-82A Post-Treatment 17 July 2012

WCS# 15A ps54b MW-OU1-82A Pre-Treatment 5 April 2012

WCS# 15A ps54b MW-OU1-82A Post-Treatment 17 July 2012

WCS# 15A ps55a MW-OU1-82A Pre-Treatment 5 April 2012

WCS# 15A ps55a MW-OU1-82A Post-Treatment 17 July 2012

WCS# 15A ps55b MW-OU1-82A Pre-Treatment 5 April 2012

WCS# 15A ps55b MW-OU1-82A Post-Treatment 17 July 2012

WCS# 16A ps31a SB-OU1-2004K Pre-Treatment 5 April 2012

WCS# 16A ps31a SB-OU1-2004K Post-Treatment 17 July 2012

WCS# 16A ps32a SB-OU1-2004K Pre-Treatment 5 April 2012

WCS# 16A ps32a SB-OU1-2004K Post-Treatment 17 July 2012

WCS# 16A ps32b SB-OU1-2004K Pre-Treatment 5 April 2012

WCS# 16A ps32b SB-OU1-2004K Post-Treatment 17 July 2012

WCS# 16A ps33a SB-OU1-2004K Pre-Treatment 5 April 2012

WCS# 16A ps33a SB-OU1-2004K Post-Treatment 17 July 2012

WCS# 16A ps33b SB-OU1-2004K Pre-Treatment 5 April 2012

WCS# 16A ps33b SB-OU1-2004K Post-Treatment 17 July 2012

WCS# 17A ps15a IW-OU1-02-A Pre-Treatment 5 April 2012

WCS# 17A ps15a IW-OU1-02-A Post-Treatment 17 July 2012

WCS# 17A ps16a IW-OU1-02-A Pre-Treatment 5 April 2012

WCS# 17A ps16a IW-OU1-02-A Post-Treatment 17 July 2012

WCS# 18A ps41a MW-OU1-88-A Pre-Treatment 5 April 2012

WCS# 18A ps41a MW-OU1-88-A Post-Treatment 17 July 2012

WCS# 18A ps42a MW-OU1-88-A Pre-Treatment 5 April 2012

WCS# 18A ps42a MW-OU1-88-A Post-Treatment 17 July 2012