

# **On-site Soil Investigations**

**Keuka Road, Concord, Massachusetts**



**Requested by: Concord Conservation Commission**

**Prepared by: Peter C. Fletcher**

**October 2013**

# **On-site Investigations Report**

**Date:** October 31, 2013

**Project:** Keuka Road Project

**Location:** Keuka Road, Concord, Massachusetts (MAP F09, PCLS 3838, 3842-2, 3837, 3849)

**Requested by:** Concord Conservation Commission

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## **Objective**

Review the wetland line as shown on the Resource Area Delineation Plan, prepared by Markey & Rubin Civil Engineers, revised 10/15/2013; to determine if it is consistent with the extent of wetland soils (hydric). The focus of these investigations was an area in the western portion of the Site between Wetland Line WFA (WFA-19 through WFA-22R) and Wetland Line WFB (WFB-23R through WFB-24). Refer to the attached Resource Area Delineation Plan for the location of the area of concern.

## **Site Description**

The Site is located north of Main Street, just north of the intersection of Main Street and Old Road to Nine Acre Corner in the Town of Concord, Massachusetts. The area of concern is nearly level throughout and thickly vegetated with tall grasses, herbaceous plants, vines, woody shrubs and saplings. Prior to conducting these investigations, this area of the Site was mowed. At the time these investigations were conducted, there was a ponded area immediately to the south and a ditch to the north that had water flowing within it. Refer to the attached USGS Topographic Map for the location of the Site (shown in red).

## **Review of Reference Materials**

**Resource Area Delineation Plan (revised 10/15/2013), prepared by Markey & Rubin Civil Engineers.**

**Mc Callar Tract, Concord, Mass. (July, 1913), Newell D. Atwood Agent.**

**USGS Topographic Map (Maynard Quadrangle):** On the USGS Topographic Map the Site is shown as a nearly level open field. Refer to the USGS Topographic Map for the general relief and location of cultural features within the area.

### **Aerial Photographs:**

1938 Black & White Aerial Photograph (USDA NRCS): the Site is shown as several open fields. Note: the imagery on the photograph is of poor quality.

1952 Black & White Aerial Photograph (USDA NRCS): the Site is shown as several open fields. A dark, linear, north south image is interpreted as an open ditch with water in it that crosses the fields.

1960 Black & White Aerial Photograph (USDA NRCS): the Site is shown as a large open field. A dark, linear, north south image is interpreted as an open ditch with water in it that extends from the southern boundary of the Site and ends midway through the field. A dark linear image that parallels the northern boundary of the Site is interpreted as a ditch with water in it. Refer to the attached aerial photograph to observe these features.

### **USDA Natural Resources Conservation Service, Soil Survey of Middlesex County,**

**Massachusetts:** The USDA, Natural Resources Conservation Service, Soil Survey of Middlesex County is available on the Internet and shows the soil mapping for the Site. The entire Site is mapped as Swansea muck, 0 to 1 percent slopes (Map Unit 51A). Swansea soils are very poorly drained soils that formed in shallow deposits of organic matter underlain by sands and gravel. Swansea soils are classified as wetland soils (hydric) by the USDA. Refer to the USDA, NRCS, Soil Map for the location and extent of the different soil types mapped within the area.

**DEP Wetlands Map:** The Massachusetts Department of Environmental Protection, Wetlands Conservancy Program identifies and delineates the different kinds of wetlands found within the State using a combination of aerial photographic interpretation and field ground truthing. The different kinds of wetlands are delineated using an aerial photo base. Most of the Site is shown as upland. The DEP Wetlands Map identifies areas of Wooded Swamp Deciduous (WS1) in the northwestern portion of the Site. There are areas of Wooded Swamp (WS21), Shallow Marsh

(M), and Shrub Swamp (SS) along the northern and eastern boundaries of the Site. There is also an area of Wooded Swamp (WS1) in the south central portion of the Site. Refer to the DEP Wetlands Map for the general location and extent of wetlands mapped within the Site and abutting areas.

**Current Ground-water Conditions (USGS):** The US Geological Survey maintains a network of monitoring wells throughout Southern New England that record monthly fluctuations in the ground-water. For August of 2013, ground-water levels within this region were in the normal (25 to 75 percentile) to above normal (76 to 90 percentile) range for a typical August. Groundwater elevation measurements for these wells are typically recorded during the third week of the month and closely approximate the ground-water conditions for late August and early September, when these investigations were conducted. Refer the USGS Current Ground-water Conditions Map for August 2013.

Copies of the reference materials reviewed for this report are in the Appendix Section.

## **Site Walk and On-site Soil Investigations**

**August 19, 2013 - Site Walk:** The purpose of the site walk was to review the Site in the field, and discuss the pertinent issues that need to be addressed. Present on the site walk were Delia Kaye, Natural Resources Director for the Town of Concord; Lori Capone, Assistant Natural Resources Director; Scott Goddard, Wetland Scientist with Goddard Consulting; Dan Wells, Wetland Scientist with Goddard Consulting; and Peter C. Fletcher, Certified Professional Soil Scientist representing the Town of Concord. During the site walk portions of the wetland line were reviewed in the field and several areas along the wetland line were identified for further investigation and review. At this time, it was agreed by those present that the vegetation was too dense to conduct on-site soil investigations and it was decided to postpone the investigations until the Applicant could have the area in question mowed.

**September 5, 2013 - On-site Soil Investigations:** Eight soil test pits were dug within the area in question. The test pits were hand dug using a tile spade (long-narrow bladed shovel) and Dutch auger (drill-like tool). The depth of the test pits ranged from 18 to 22 inches deep. For the area in question and the locations of the soil test pits refer to the attached Resource Area Delineation Plan.

**Soil Test Pit STP 1:** At STP 1 the plow layer (Ap horizon) was 13 inches thick and was a black sandy loam. The subsoil (Bhs horizon) was a dark brown, very gravely, loamy coarse sand. There were soil features that indicated periods of soil saturation and reduction (redoximorphic) starting at 13 inches below the ground surface. No groundwater was observed standing or

weeping in the test pit at the time these soil investigations were conducted. For a more detailed description of the soil features at Soil Test Pit STP 1 refer to the Soil Investigations/Field Notes Form in the Appendix of this report.

**Soil Test Pit STP 1A:** At STP 1A the plow layer (Ap horizon) was 15 inches thick and was a black sandy loam. The upper part of the subsoil (Bw horizon) was a brown sandy loam. The lower part of the subsoil (BC horizon) was a dark brown, very gravely, loamy coarse sand. There were soil features that indicated periods of soil saturation and reduction (redoximorphic) starting at 15 inches below the ground surface. No groundwater was observed standing or weeping in the test pit at the time these soil investigations were conducted. For a more detailed description of the soil features at Soil Test Pit STP 1A refer to the Soil Investigations/Field Notes Form in the Appendix of this report.

**Soil Test Pit STP 2:** At STP 2 the plow layer (Ap horizon) was 12.5 inches thick and was a black sandy loam. The subsoil (Bhs horizon) was a dark reddish brown, very gravely, loamy coarse sand. There were soil features that indicated periods of soil saturation and reduction (redoximorphic) starting at 12.5 inches below the ground surface. No groundwater was observed standing or weeping in the test pit at the time these soil investigations were conducted. For a more detailed description of the soil features at Soil Test Pit STP 2 refer to the Soil Investigations/Field Notes Form in the Appendix of this report.

**Soil Test Pit STP 2A:** At STP 2A the plow layer (Ap horizon) was 15 inches thick and was a black sandy loam. The upper part of the subsoil (Bhs1 horizon) was a dark brown sandy loam. The lower part of the subsoil (Bhs2 horizon) was a dark reddish brown, very gravely, loamy coarse sand. There were soil features that indicated periods of soil saturation and reduction (redoximorphic) starting at 15 inches below the ground surface. No groundwater was observed standing or weeping in the test pit at the time these soil investigations were conducted. For a more detailed description of the soil features at Soil Test Pit STP 2A refer to the Soil Investigations/Field Notes Form in the Appendix of this report.

**Soil Test Pit STP 3:** At STP 3 the upper part of the plow layer (Ap horizon) was 9.5 inches thick and was a black sandy loam. The lower part of the topsoil (A/B horizon) was a mix of black and dark brown sandy loam. The subsoil (Bhs horizon) was a dark reddish brown, very gravely, loamy coarse sand. There were soil features that indicated periods of soil saturation and reduction (redoximorphic) starting at 9.5 inches below the ground surface. No groundwater was observed standing or weeping in the test pit at the time these soil investigations were conducted. For a more detailed description of the soil features at Soil Test Pit STP 3 refer to the Soil Investigations/Field Notes Form in the Appendix of this report.

**Soil Test Pit STP 4:** At STP 4 the plow layer (Ap horizon) was 12 inches thick and was a black sandy loam. The upper part of the subsoil (Bhs1 horizon) was a dark brown, sandy loam. The lower part of the subsoil (Bhs2 horizon) was a dark reddish brown, very gravely, loamy coarse sand. There were soil features that indicated periods of soil saturation and reduction (redoximorphic) starting at 12 inches below the ground surface. No groundwater was observed standing or weeping in the test pit at the time these soil investigations were conducted. For a more detailed description of the soil features at Soil Test Pit STP 4 refer to the Soil Investigations/Field Notes Form in the Appendix of this report.

**Soil Test Pit STP 5:** At STP 5 the plow layer (Ap horizon) was 10 inches thick and was a black sandy loam. The upper part of the subsoil (Bw horizon) was a dark brown, sandy loam. The lower part of the subsoil (BC horizon) was a very dark brown, very gravely, loamy coarse sand. There were soil features that indicated periods of soil saturation and reduction (redoximorphic) starting at 10 inches below the ground surface. No groundwater was observed standing or weeping in the test pit at the time these soil investigations were conducted. For a more detailed description of the soil features at Soil Test Pit STP 5 refer to the Soil Investigations/Field Notes Form in the Appendix of this report.

**Soil Test Pit STP 6:** At STP 6 the plow layer (Ap horizon) was 10.5 inches thick and was a black sandy loam. The upper part of the subsoil (Bw horizon) was a dark brown, sandy loam. The lower part of the subsoil (BC horizon) was a dark brown, very gravely, loamy coarse sand. There were soil features that indicated periods of soil saturation and reduction (redoximorphic) starting at 15 inches below the ground surface. No groundwater was observed standing or weeping in the test pit at the time these soil investigations were conducted. For a more detailed description of the soil features at Soil Test Pit STP 6 refer to the Soil Investigations/Field Notes Form in the Appendix of this report.

## Findings

The Massachusetts Department of Environmental Protection Wetland Handbook, Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act (March 1995) states that “when the BVW boundary based on vegetation alone is not presumed accurate, or to overcome the presumption, vegetation and hydrology should both be used to establish the BVW boundary.” Wetland soils (hydric) are considered very reliable indicators of long-term hydrology. In areas where the BVW boundary is not abrupt or discrete, the DEP Wetland Handbook specifies the use of vegetation and hydrology (hydric soils). At this Site, in the area in question, the land surface is nearly level throughout with only very subtle slope breaks.

The DEP Wetland Handbook lists seven Hydric Soil Indicators that can be used in most situations to identify hydric soils in the field. However, certain soils are more difficult to assess, making it harder to determine whether hydric conditions exist. In these situations, the Handbook identifies Difficult to Analyze hydric soil conditions. At this Site the soils are difficult to analyze because they have A horizons that are thick and very dark and/or have evidence of Spodic development (evergreen forest soils).

At Soil Test Pits STP-2A, STP-2, STP-3 and STP-4 there was evidence of Spodic development. At Soil Test Pits STP- 1, STP-2A and STP-2 the soils had a thick plow layer greater than 12 inches thick.

**At Soil Test Pit STP-1**, the soil was classified as an upland soil. The soil at STP-1 had a thick very dark A horizon but did not meet the criteria for a Difficult to Analyze soil with A horizons that are thick and very dark.

**At Soil Test Pit STP-1A**, the soil was classified as an upland soil. The soil at STP-1A had a thick very dark A horizon but did not meet the criteria for a Difficult to Analyze soil with A horizons that are thick and very dark.

**At Soil Test Pit STP-2**, the soil classified as a Difficult to Analyze wetland soil (hydric) using the Spodic indicator (evergreen forest soils).

**At Soil Test Pit STP-2A**, the soil was classified as an upland soil. The soil at STP-2A had a thick very dark A horizon but did not meet the criteria for a Difficult to Analyze soil with A horizons that are thick and very dark.

**At Soil Test Pit STP-3**, the soil classified as a Difficult to Analyze wetland soil (hydric) using the Spodic indicator (evergreen forest soils).

**At Soil Test Pit STP-4**, the soil classified as a Difficult to Analyze wetland soil (hydric) using the Spodic indicator (evergreen forest soils).

**At Soil Test Pit STP-5**, the soil classified as an upland soil (non-hydric).

**At Soil Test Pit STP-6**, the soil classified as an upland soil (non-hydric).

## Conclusion

The on-site investigation conducted for this report confirm that delineating the wetland boundary within the area in question is challenging do to the nearly level terrain and the difficult to analyze soil conditions. The fact that several qualified wetland scientists have delineated different wetland lines within this area is testament to this.

Prior to conducting the on-site soil investigations at this Site, the area of concern was mowed to allow for the view of the micro-topography. This enabled the accurate placement of the soil test pits. Eight soil test pits were dug and additional auger holes investigated.

The on-site soil investigations conducted for this report confirm that there is a relatively narrow band of upland soils that separate the wetland to the northwest (WFA-19 through WFA-22R) from the wetland to the southeast (WFB-23R through WFB-24 ). These investigations confirm that the extent of wetland soils (hydric) is greater than those shown on the Resource Area Delineation Plan (revised 10/15/2013), prepared by Markey & Rubin Civil Engineers. Refer to the attached enlarged section of the Resource Area Delineation Plan for the location of the wetland soil line (hydric) confirmed by these on-site soil investigations.

### **Need for Additional Investigations**

The images on the 1952 and 1960 aerial photographs indicate that there may have been a ditch that connected a wetland in the southern portion of the Site to the ditch that parallels the northern boundary of the Site. This was confirmed on the 1913 McCallar Tract, Concord, Mass. Site Plan. The 1960 imagery indicates that the northern portion of this ditch may have been covered over with earthen material.

At the end of the day following the soil investigations described in this report, the location of a suspected buried clay drainage tile was investigated. Using a tile probe it was confirmed that there was a buried clay drain tile within the area of concern. Preliminary investigations confirmed that there is a submerged end of a clay tile in the ponded area located in the southwestern portion of the Site and shown on the Resource Area Delineation Plan. These investigations then indicate that a buried section of this pipe continues in a northerly direction through the wetland area in the general vicinity of Wetland Flags WFB-23R and WFB-24. Preliminary investigations along the southern edge of the ditch that parallels the northern edge of the Site confirmed a buried section of clay drainage tile that outlets into a small swale on the southern bank of the drainage ditch. It is suspected that these clay tiles are connected, and the southern end is the inlet and the northern the outlet. The description of the outlet for the clay drainage tile is inaccurate on the Resource Area Delineation Plan (revised 10/15/2013). The outlet is labeled "PIPE OUTLET CRUSHED PIPE". Unless the Applicant's Wetland Consult has constructed additional investigations, my preliminary investigations indicated that the clay drainage pipe was not crushed.

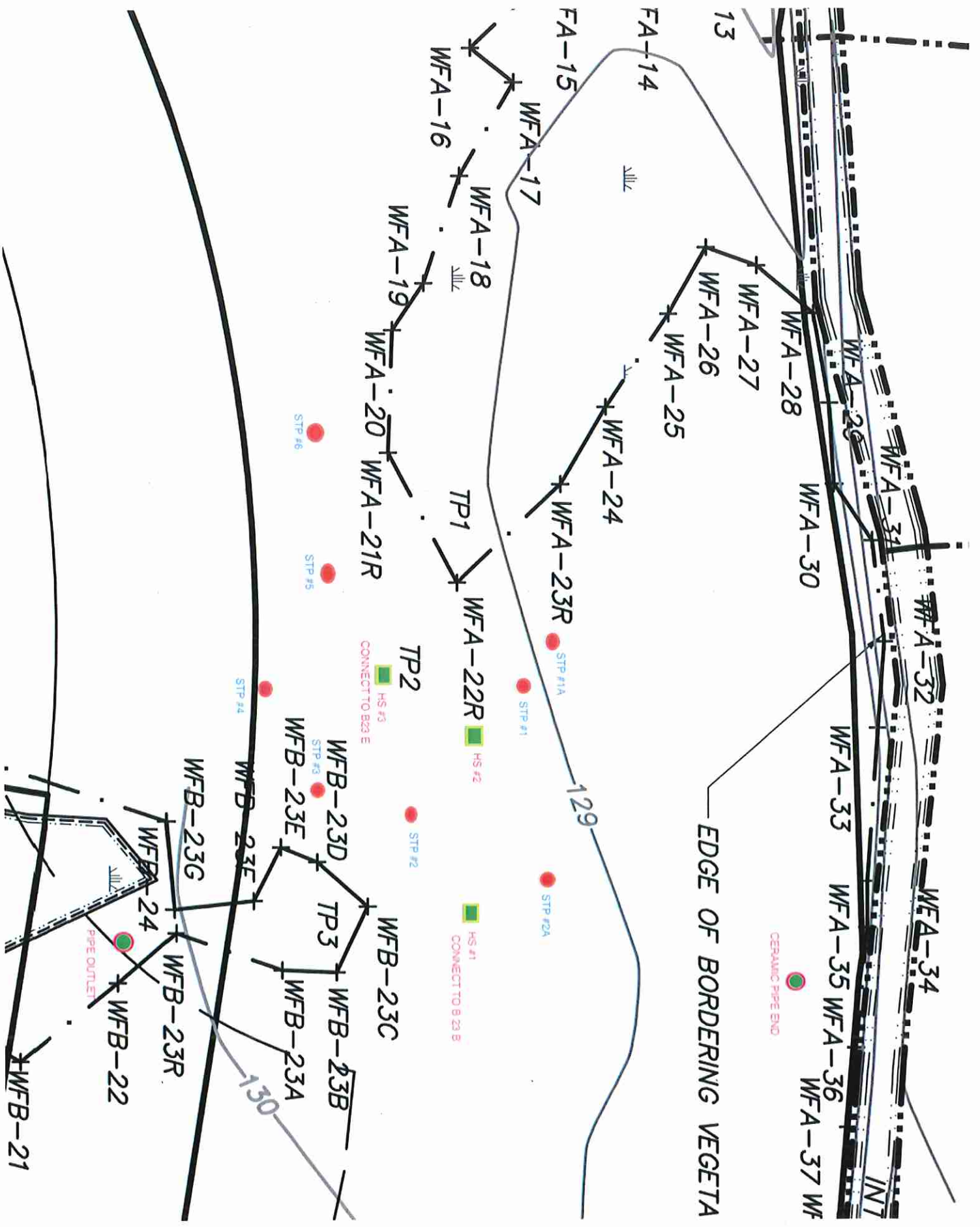
Because these investigations were conducted at the end of the day there was only time to confirm the presence of the buried clay drain tile, but not enough time to evaluate the soil characteristics in the vicinity of the pipe. The Applicant's consultant was unaware of the buried clay drainage tile and did not address this in his report. It is recommended that additional investigations be conducted to determine the location of the clay tile, verify its current



condition, examine the soils along the pipe, and determine if the outlet of the clay drainage tile connects to the wetland area that borders the ditch to the north.

If a hydrologic connection is confirmed between Wetland WFA and Wetland WFB, the wetland line for Wetland WFB will have to be checked in the field.

# Appendix



WFA-14  
 WFA-15  
 WFA-16  
 WFA-17  
 WFA-18  
 WFA-19  
 WFA-20  
 WFA-21R  
 WFA-22R  
 WFA-23R  
 WFA-24  
 WFA-25  
 WFA-26  
 WFA-27  
 WFA-28  
 WFA-29  
 WFA-30  
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 WFA-36  
 WFA-37  
 WFB-21  
 WFB-22  
 WFB-23A  
 WFB-23B  
 WFB-23C  
 WFB-23D  
 WFB-23E  
 WFB-23F  
 WFB-23G  
 WFB-24  
 TP1  
 TP2  
 TP3  
 STP #1  
 STP #2  
 STP #3  
 STP #4  
 STP #5  
 STP #6  
 HS #1  
 HS #2  
 HS #3  
 CONNECT TO 8 23 B  
 CONNECT TO B23 E  
 CERAMIC PIPE END  
 PIPE OUTLET  
 129  
 130  
 EDGE OF BORDERING VEGETA  
 INT