MEMORANDUM

To: Mr. Robert Williams, R.G.
Department of Environmental Quality
2020 SW Fourth Ave., Suite 400
Portland, OR 97201-4987

Sarah Prowell, R.G.
Prowell Environmental, Inc.
Phone: 503/452-0972
E-mail: sprowell@ix.netcom.com

Date: July 28, 2011

RE: Proposed TGA Off-site Drilling VOC Flux Evaluation
Cascade Corporation's TGA Remedy

1. Introduction

This memorandum, submitted on behalf of Cascade Corporation (Cascade), proposes installation of four off-site shallow wells in the vicinity of the Troutdale Gravel Aquifer (TGA) erosional truncation. Monitoring data from the wells will be used to evaluate residual volatile organic compounds (VOCs) flux in the area where the TGA plume historically discharged into the TSA. The off-site TGA wells, remedy features, and recent VOC concentrations are shown in Figure 1.

2. Scope Overview and Purpose

Two shallow monitoring well clusters will be drilled and installed in the central and eastern vicinity of the off-site TGA erosional truncation, at approximate locations shown in Figure 2. This is an area near the truncation where highest historical trichloroethene (TCE) concentrations occurred. One Lower TGA and one Siltstone Transition Zone (STZ) well will be installed at each well cluster location. They will be located north of the bioremediation mulch treatment wall and near the southern perimeter of the poplar tree field, where drilling access is feasible, the TGA is present, and highest residual VOC concentrations are anticipated. The wells will be used to monitor water levels and VOC concentrations and to obtain information on aquifer properties in each of the units.

The existing off-site remedy well network includes five wells with screens intercepting both the Lower TGA and STZ (see Table 1). Samples from three of the wells (B-5, B-6, and MW-42) represent blended water quality from both the TGA and the STZ, while samples from two of the wells (MW-45 and MW-46) represent STZ water quality due to low water levels near the base of the well screen interval. The new TGA/STZ well clusters will provide discrete monitoring data for each horizon. These data will be used to evaluate residual contaminant flux in both the Lower TGA and the STZ near the erosional truncation.

3. Background

Historically the highest TCE concentrations near the erosional truncation occurred in wells screened in both the Lower TGA and the STZ (B-6, MW-42, and MW-45) [1]. This is consistent with the southerly dip of these units (see Attachment A for cross-section). Historically, on-site TGA VOC-bearing groundwater flowed northward into underlying off-site hydrostratigraphic horizons, as those horizons rise in elevation to the north.

The TGA and underlying fine-grained deposits consist of a fining-downward sequence of gravel, underlain by sandstone, siltstone, and claystone as noted in the 2002 hydrostratigraphic evaluation[2]. For purposes of the TGA remedy, the Upper TGA is identified as a well-graded sandy gravel to depths of approximately 20 feet off-site (south of the erosional truncation). The Lower TGA consists of gravelly to silty sand or cemented sandstone and is approximately 5.0 to 10.0 feet thick off-site. The TGA is underlain by a transitional interval of characteristically yellow-brown siltstone deposits identified as the STZ. This deposit is often identified as SU1a in the TSA remedy. It is found to be 2.0 to 5.0 feet thick off-site. The STZ is underlain by a characteristically green-gray claystone or clayey siltstone identified as the CU 1. Depth to the water table ranges from approximately 10 to 15 feet below ground surface off-site and seasonally declines during the low precipitation period.

4. Methods

Borehole Drilling and Core Sampling. Drilling will be performed by an Oregon-licensed and bonded well driller using a track-mounted rotosonic (sonic) drilling rig and continuous core sampling methods. All drilling and well installation methods will be conducted in accordance with Oregon Water Resource Department (OWRD) regulations or special standards approval, if needed.

Before drilling begins, underground utilities will be located, start cards will be obtained from the OWRD, and downhole drilling equipment will be decontaminated using pressure steam-cleaning methods before drilling begins. Decontamination water will be contained and transported to Cascade's off-site groundwater pre-treatment holding tank for air stripper treatment. Health and safety procedures will be reviewed with all field personnel and safety monitoring equipment will be calibrated for use in monitoring vapors within the breathing zone during drilling.

Each of the four boreholes will be drilled as approximate 6-inch diameter holes. Temporary casing of similar diameter will be advanced during drilling to total depth (estimated to be between 20 to 30 feet). Continuous core soil sampling will be performed from ground surface to total drill depth at each location. The cores will be lithologically logged using visual-manual methods in general accordance with the American Society for Testing and Materials (ASTM) D 2488 procedures. Selected soil samples may

---

[1] *2002 Performance Evaluation, TGA Remedial Action*, Prowell Environmental and Pegasus Geoscience, February 28, 2003.

[2] *Appendix B. Hydrostratigraphic Unit Designations, 2002 Performance Evaluation, TGA Remedial Action*.

be additionally submitted for sieve and grain size distribution analyses. The cores will be photographed and selected intervals will be boxed, labeled, and stored on-site.

Well Installation. Each well assembly will be constructed of 2-inch diameter, flush-threaded, Schedule 40 PVC pipe. The well screen is anticipated to have a slot size 0.02-inch. Screen lengths will be determined in the field but are anticipated to be less than 10 feet in TGA wells and less than 5 feet in STZ wells. The base of the well assembly will be fitted with a threaded well plug and the assembly will be lowered into the well and centered in the borehole. Clean silica sand filter pack of 8 X 12 or 10 x 20 size will be poured slowly into the annular space. The filter pack will extend from one foot below the base of well screen to approximately two feet above the top of well screen. A bentonite chip or coated pellet seal will be poured into the annular space above the filter pack to within approximately 1 foot of ground surface and allowed to hydrate before wellhead completion is constructed. The temporary well casing will be lifted and removed during well filter pack and seal installations. An above-grade completion will then be installed, including concrete-filled protective stanchions and a protective outer steel well casing set in a concrete well pad, per OWRD regulations. The PVC well head will be capped and the outer steel casing will be capped and locked. The OWRD will secure a state identification number tag to the well.

Well Development, Sampling, and Survey. The wells will be developed by surging and bailing groundwater in the casing to remove approximately 10 well casing volumes of water. The surge action is intended to create movement of water between the aquifer formation, filter pack, and well assembly, for removal during subsequent bailing. Specific conductance, pH, and temperature will be measured during well development. The development will be considered complete after water in the casing appears clear. At least 72 hours after well development is complete, water levels will be measured and purge samples will be collected from each well for VOC analysis using EPA Method 8260B.

Well coordinates will be surveyed by a licensed surveyor for ground surface and top of casing elevations (to the nearest 0.01 foot) and for horizontal easting and northing coordinates (to the nearest 0.1 foot).

Slug Tests. Slug tests will be performed in each of the new wells to provide estimates of the hydraulic conductivity in the Lower TGA and the STZ near the erosional truncation. The tests will be conducted in general accordance with procedures described in the *TSA Remedy Work Plan for Slug Tests and Recovery Tests* memorandum prepared by S. S. Papadopulos & Associates, Inc., dated June 28, 2011.

***Waste Management*.** Soil cuttings generated during drilling will be placed in either 55-gallon capacity drums (labeled to identify generation location, date of generation, and media) or in a lined roll-off box with cover. Representative waste samples will be collected for laboratory analysis of VOCs using EPA Method 8260B. The results will be used to identify waste classification and develop disposal plans.

5. Reporting

A report of findings and construction records will be submitted to DEQ, including the following:

- Lithologic soil boring and well construction logs
- Groundwater sample VOC analytical results
- Soil grain size laboratory results (if analyzed)
- Well development records, well survey coordinates, and water level measurements.

Attachments:

Figure 1. Off-Site Well Locations and TCE /VC Concentrations – February 2011
Figure 2. Proposed Off-site Well Locations
Table 1. Off-site Well Screens Intercepting the Siltstone Transition Zone
Attachment A. TGA North - South Lithologic Cross-Section

cc: John Cushing, Cascade Corporation
Charles Andrews, S.S. Papadopulos & Associates, Inc.

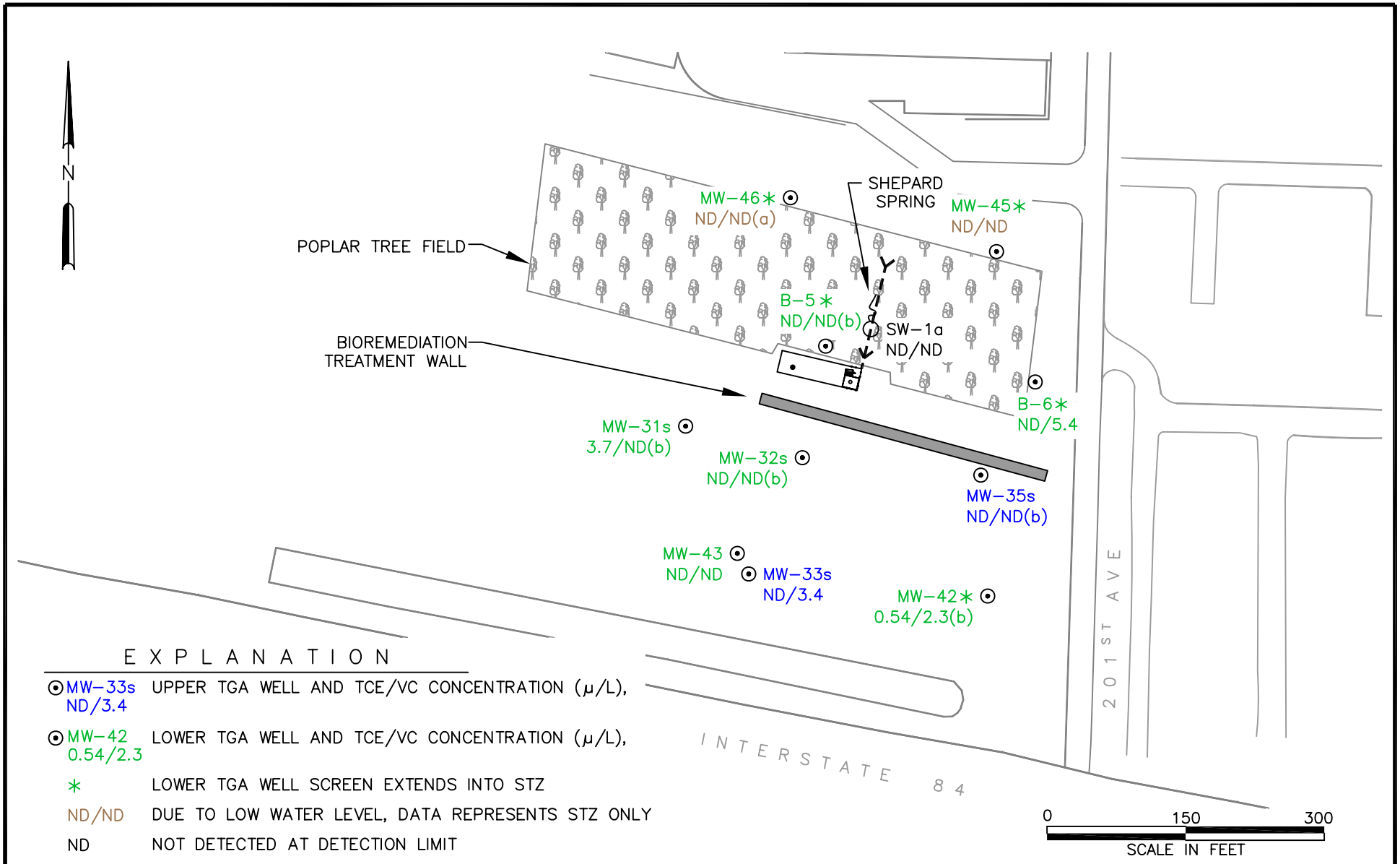

Figure 1
Off-Site Well Locations and
TCE/VC Concentrations – February 2011
Cascade Corporation – TGA Remedy

Y:\Prowell Environmental\Cascade\TGA 11 Drilling\Fig1b.dwg 7/28/11

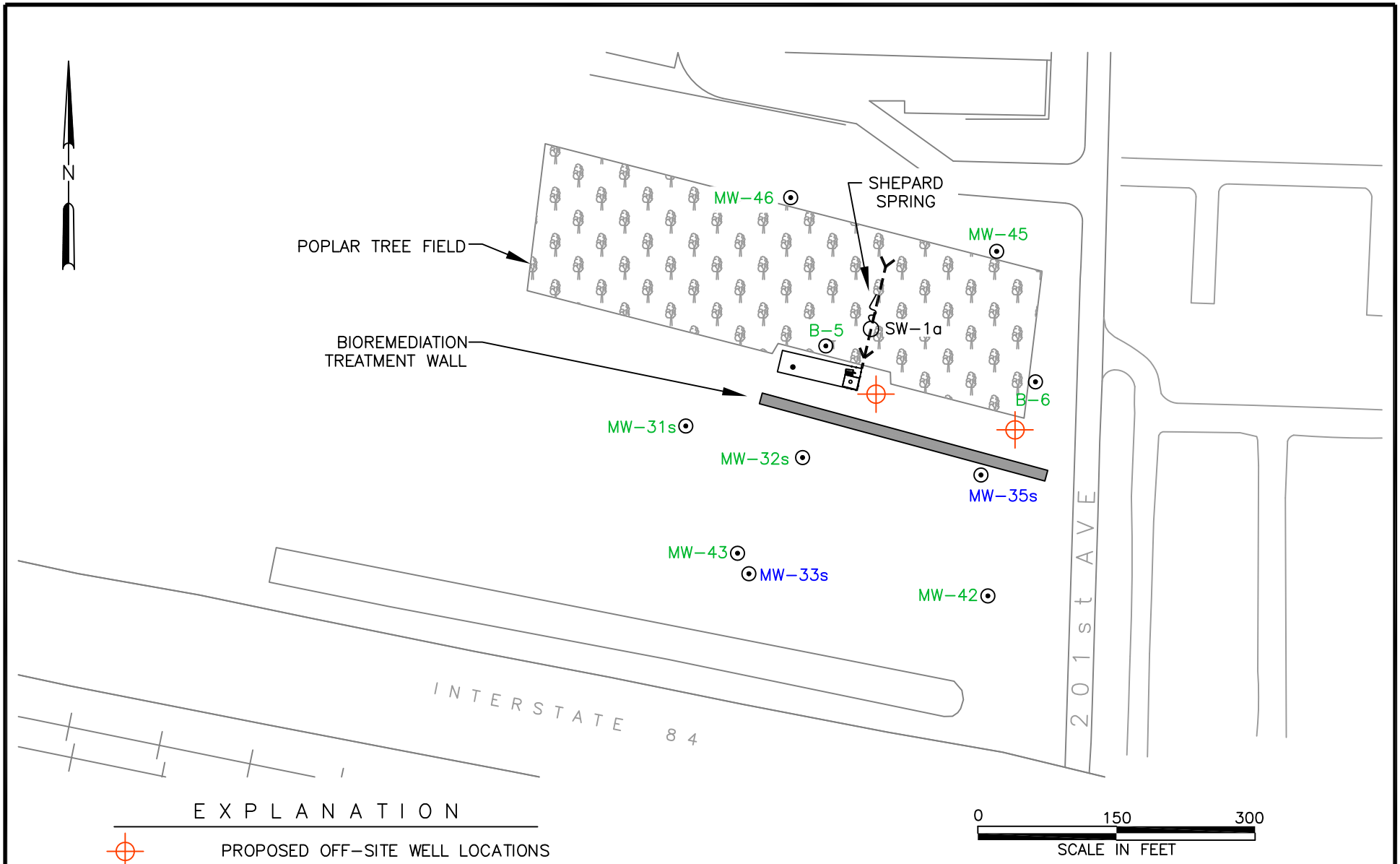

Figure 2
Proposed Off-Site Well Locations
Cascade Corporation – TGA Remedy

Y:\Prowell Environmental\Cascade\TGA 11 Drilling\Fig2.dwg 7/25/11

Off-site Well Screens Intercepting the Siltstone Transition Zone
2011 Remedy Well Network
Cascade Corporation - TGA Remedy

Lower TGA Wells Intercepting STZ	Screen Depth (ft, bgs)		STZ Depth Interval (ft, bgs)	Depth to Water (ft, bgs)		TCE Concentration (µg/L)		Water Levels Within STZ Depth Interval?
	Top	Bottom		Feb. 2011	Aug. 2010	Feb. 2011	Aug. 2010	
Off-site Wells North of Former Trench / Current Mulch Biowall								
B-5[a]	15.6	20.6	20.1 - >20.6	11.1	12.6	NS	4.0	No
B-6	11.0	16.0	13 - 16	5.8	7.3	<0.5	0.60	No
Off-site Wells South of Former Trench / Current Mulch Biowall								
MW-42	18.0	28.0	25.5 - 30.5	NM	16.2	NS	0.54	No
MW-45	9.7	19.5	11.5 - 19.2	15.7	18.2	<0.5	<0.5	Yes; STZ only
MW-46	7.2	14.5	10.6 - 15.0	13.8	14.1	NS	<0.5[b]	Yes; STZ only

NOTES:

[a] B-5 re-surveyed January 2000 due to change in ground surface elevation after 1993 well installation; thus screen and contact depths tabled above differ from depths on well log.

[b] MW-46 sampled once every two years; posted concentration is for August 2009.

Above 2011 off-site remedy monitoring wells include those for which base of screen extends below TGA into STZ.

STZ = Siltstone Transition Zone; ft, bgs = feet below ground surface; µg/L = micrograms per liter; NS = not sampled in February; NM = not measured in February.

BLUE = wells for which data represent STZ conditions (i.e., screen extends into STZ and water levels are below TGA/STZ contact).

TGA annual sampling performed in August; TGA semiannual sampling performed in February.

Where sampled in duplicate, average is shown.

Attachment A

TGA North – South Lithologic Cross-Section

(Source: Appendix B of 2002 Performance Evaluation, TGA Remedial Action; Prowell Environmental and Pegasus Geoscience, February 28, 2003)

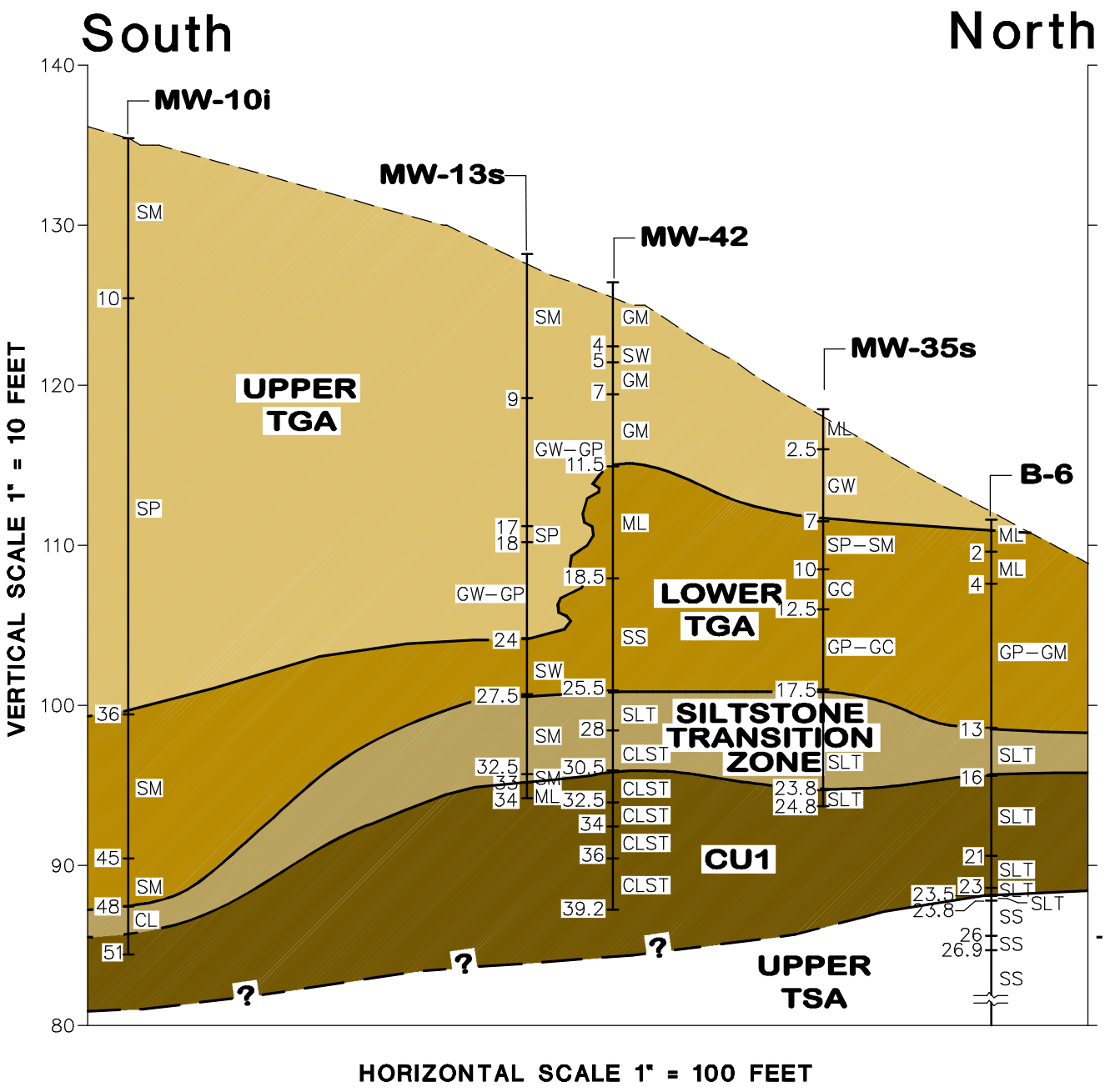

Figure B–4
Lithologic Cross–Section C–C'
TGA Remedy
Cascade Corporation

GEOSEC–C1A.DWG GRH 1/15/03