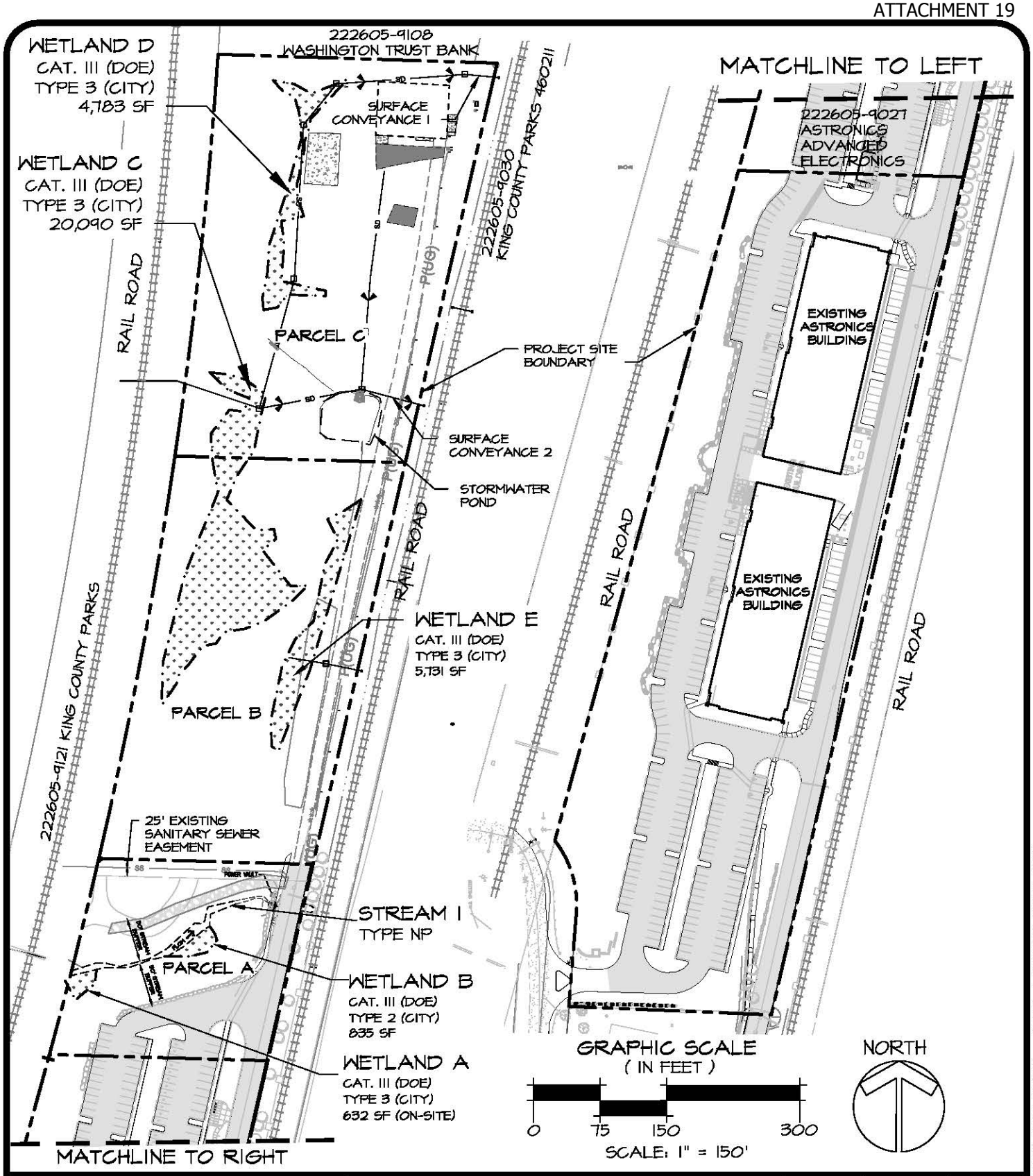

TALASAEA CONSULTANTS, INC.
Resource & Environmental Planning
15020 Bear Creek Road Northeast
Woodinville, Washington 98077
Bus (425)861-7550 - Fax (425)861-7549

FIGURE #2

EXISTING CONDITIONS OVERVIEW
ASTRONICS EXPANSION
KIRKLAND, WASHINGTON

DESIGN	DRAWN	PROJECT
	ABS	1467
SCALE	AS SHOWN	
DATE		2
REVISED	3-13-2015	

Z:\DRAWING\1400-1499\TAL1467\Plans\TAL-1467 WP FINAL.DWG

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IMAGE SOURCE: GOOGLE MAPS, WWW.MAPS.GOOGLE.COM (ACCESSED 27 JANUARY 2015)

NORTH

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FIGURE #3
EXISTING CONDITIONS SURFACE WATER FLOW CONDITIONS
ASTRONICS EXPANSION
KIRKLAND, WASHINGTON

DESIGN	DRAWN	PROJECT
ABS	ABS	1467
SCALE NTS		
DATE		3
REVISED 3-13-2015		

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GRAPHIC SCALE
(IN FEET)

0 350 700 1400

SCALE: 1"=700'

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FIGURE #4

ACTION AREA

ASTRONICS EXPANSION
KIRKLAND, WASHINGTON

DESIGN	DRAWN	PROJECT
	ABS	1467
SCALE	AS SHOWN	
DATE		4
REVISED	3-13-2015	

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APPENDIX 1.

Temporary Erosion/Sediment Control Plan for Astronics North Building Addition

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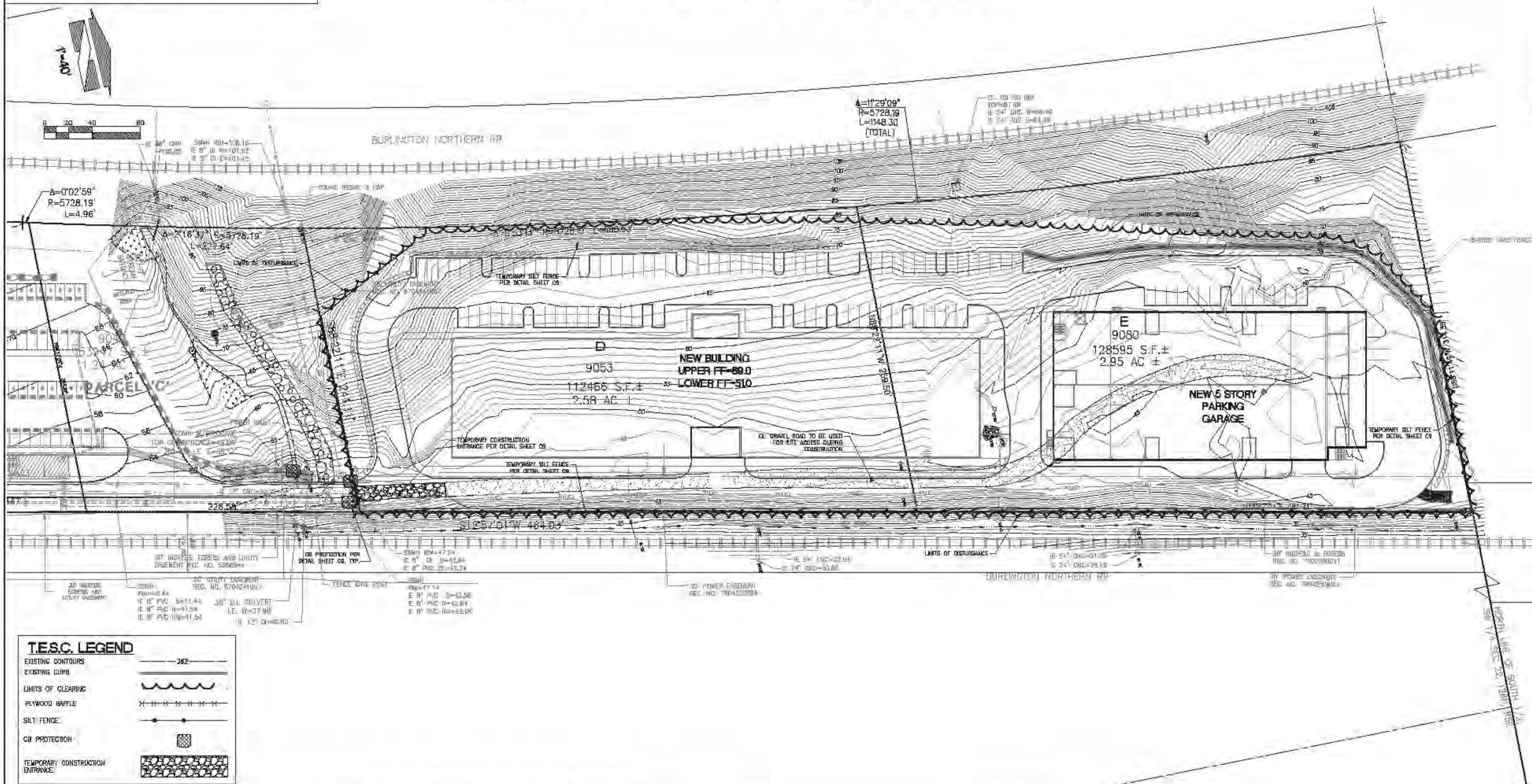
UTILITY CONFLICT NOTE:

CAUTION:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION, AND DEPTH OF ALL EXISTING UTILITIES WHETHER SHOWN ON THESE PLANS OR NOT BY POTHOLING THE UTILITIES AND SURVEYING THE HORIZONTAL AND VERTICAL LOCATION PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE CALLING UTILITY LOCATE @ 1-800-424-5555 AND THEN POTHOLING ALL OF THE EXISTING UTILITIES AT LOCATIONS OF NEW UTILITY CROSSINGS TO PHYSICALLY VERIFY WHETHER OR NOT CONFLICTS EXIST. LOCATIONS OF SAID UTILITIES AS SHOWN ON THESE PLANS ARE BASED UPON THE UNVERIFIED PUBLIC INFORMATION AND ARE SUBJECT TO VARIATION. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL CONSULT BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.

TEMPORARY EROSION/SEDIMENT CONTROL PLAN FOR ASTRONICS NORTH BUILDING ADDITION

CALL BEFORE YOU DIG: 1-800-424-5555



CITY OF KIRKLAND EROSION/SEDIMENTATION CONTROL - PLAN NOTES

1. THE APPROVED CONSTRUCTION SEQUENCE SHALL BE AS FOLLOWS:
   A. CONDUCT PRE-CONSTRUCTION MEETING.
   B. FLAG OR FENCE CLEARING LIMITS.
   C. POST SIGN WITH NAME AND PHONE NUMBER OF TESC SUPERVISOR.
   D. INSTALL CATCH BASIN PROTECTION IF REQUIRED.
   E. GRADE AND INSTALL CONSTRUCTION ENTRANCE(S).
   F. INSTALL PERIMETER PROTECTION (SILT FENCE, BRUSH BARRIER, ETC.).
   G. CONSTRUCT SEDIMENT PONDS AND TRAPS.
   H. GRADE AND STABILIZE CONSTRUCTION ROADS.
   I. CONSTRUCT SURFACE WATER CONTROLS (INTERCEPTOR DIKES, PIPE SLOPE DRAINS, ETC.) SIMULTANEOUSLY WITH CLEARING AND GRADING FOR PROJECT DEVELOPMENT.
   J. MAINTAIN EROSION CONTROL MEASURE IN ACCORDANCE WITH CITY OF KIRKLAND STANDARDS AND MANUFACTURER'S RECOMMENDATIONS.
   K. RELOCATE EROSION CONTROL MEASURES OR INSTALL NEW MEASURES SO THAT AS SITE CONDITIONS CHANGE, THE EROSION AND SEDIMENT CONTROL IS ALWAYS IN ACCORDANCE WITH THE CITY TESC MINIMUM REQUIREMENTS.
   L. COVER ALL AREAS WITHIN THE SPECIFIED TIME FRAME WITH STRAW, WOOD FIBER MULCH, COMPOST, PLASTIC SHEETING, CRUSHED ROCK OR EQUIVALENT.
   M. STABILIZE ALL AREAS THAT REACH FINAL GRADE WITHIN 7 DAYS.
   N. SEED OR SOD ANY AREAS TO REMAIN UNWORKED FOR MORE THAN 30 DAYS.
   O. UPON COMPLETION OF THE PROJECT, ALL DISTURBED AREAS MUST BE STABILIZED AND BEST MANAGEMENT PRACTICES REMOVED IF APPROPRIATE.
2. APPROVAL OF THIS EROSION/SEDIMENTATION CONTROL (ESC) PLAN DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT ROAD OR DRAINAGE DESIGN (E.G., SIZE AND LOCATION OF ROADS, PIPES, RESTRICTORS, CHANNELS, RETENTION FACILITIES, UTILITIES, ETC.).
3. THE IMPLEMENTATION OF THIS ESC PLAN AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE PERMITTEE/CONTRACTOR UNTIL ALL CONSTRUCTION IS APPROVED.
4. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THIS PLAN SHALL BE SET BY SURVEY AND CLEARLY FLAGGED IN THE FIELD BY A CLEARING CONTROL FENCE PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE OR REMOVAL OF ANY GROUND COVER BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE PERMITTEE/CONTRACTOR FOR THE DURATION OF CONSTRUCTION.
5. THE ESC FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED PRIOR TO OR IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT-LADEN WATER DOES NOT ENTER THE DRAINAGE SYSTEM OR VIOLATE APPLICABLE WATER STANDARDS. WHEREVER POSSIBLE, MAINTAIN NATURAL VEGETATION FOR SILT CONTROL.
6. THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED (E.G., ADDITIONAL SUMPS, RELOCATION OF DITCHES AND SILT FENCES, ETC.) AS NEEDED FOR UNEXPECTED STORM EVENTS. ADDITIONALLY, MORE ESC FACILITIES MAY BE REQUIRED TO ENSURE COMPLETE SILTATION CONTROL. THEREFORE, DURING THE COURSE OF CONSTRUCTION IT SHALL BE THE OBLIGATION AND RESPONSIBILITY OF THE CONTRACTOR TO ADDRESS ANY NEW CONDITIONS THAT MAY BE CREATED BY HIS ACTIVITIES AND TO PROVIDE ADDITIONAL FACILITIES OVER AND ABOVE THE MINIMUM REQUIREMENTS AS MAY BE NEEDED.
7. THE ESC FACILITIES SHALL BE INSPECTED BY THE PERMITTEE/CONTRACTOR DAILY DURING NON-RAINFALL PERIODS, EVERY HOUR (DAYLIGHT) DURING A RAINFALL EVENT, AND AT THE END OF EVERY RAINFALL, AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING. IN ADDITION, TEMPORARY SILTATION PONDS AND ALL TEMPORARY SILTATION CONTROLS SHALL BE MAINTAINED IN A SATISFACTORY CONDITION UNTIL SUCH TIME THAT CLEARING AND/OR CONSTRUCTION IS COMPLETED, PERMANENT DRAINAGE FACILITIES ARE OPERATIONAL, AND THE POTENTIAL FOR EROSION HAS PASSED. WRITTEN RECORDS SHALL BE KEPT DOCUMENTING THE REVIEWS OF THE ESC FACILITIES.
8. THE ESC FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN 48 HOURS FOLLOWING A STORM EVENT.
9. ALL DENUDED SOILS MUST BE STABILIZED WITH AN APPROVED TESC METHOD (E.G. SEEDING, MULCHING, PLASTIC COVERING, CRUSHED ROCK) WITHIN THE FOLLOWING TIMELINES: MAY 1 TO SEPTEMBER 30 -SOILS MUST BE STABILIZED WITHIN 7 DAYS OF GRADING. OCTOBER 1 TO APRIL 30 -SOILS MUST BE STABILIZED WITHIN 2 DAYS OF GRADING. STABILIZE SOILS AT THE END OF THE WORKDAY PRIOR TO A WEEKEND, HOLIDAY, OR PREDICTED RAIN EVENT.
10. AT NO TIME SHALL MORE THAN 1' OF SEDIMENT BE ALLOWED TO ACCUMULATE WITHIN A CATCH BASIN. ALL CATCH BASINS AND CONVEYANCE LINES SHALL BE CLEANED PRIOR TO PAVING. THE CLEANING OPERATION SHALL NOT FLUSH SEDIMENT-LADEN WATER INTO THE DOWNSTREAM SYSTEM.
11. STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES, SUCH AS WASH PADS, MAY BE REQUIRED TO ENSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.
12. ANY PERMANENT RETENTION/DETENTION FACILITY USED AS A TEMPORARY SETTLING BASIN SHALL BE MODIFIED WITH THE NECESSARY EROSION CONTROL MEASURES AND SHALL PROVIDE ADEQUATE STORAGE CAPACITY. IF THE PERMANENT FACILITY IS TO FUNCTION ULTIMATELY AS AN INFILTRATION OR DISPERSION SYSTEM, THE FACILITY SHALL NOT BE USED AS A TEMPORARY SETTLING BASIN. NO UNDERGROUND DETENTION TANK, DETENTION VAULT, OR SYSTEM WHICH BACKS UNDER OR INTO A POND SHALL BE USED AS A TEMPORARY SETTLING BASIN.
13. WHERE SEEDING FOR TEMPORARY EROSION CONTROL IS REQUIRED, FAST GERMINATING GRASSES SHALL BE APPLIED AT AN APPROPRIATE RATE (EXAMPLE: ANNUAL OR PERENNIAL RYE APPLIED AT APPROXIMATELY 80 POUNDS PER ACRE).
14. WHERE STRAW MULCH IS REQUIRED FOR TEMPORARY EROSION CONTROL, IT SHALL BE APPLIED AT A MINIMUM THICKNESS OF 2".
15. ALL EROSION/SEDIMENTATION CONTROL PONDS WITH A DEAD STORAGE DEPTH EXCEEDING 6" MUST HAVE A PERIMETER FENCE WITH A MINIMUM HEIGHT OF 3'.
16. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH CITY OF KIRKLAND STANDARDS AND SPECIFICATIONS.
17. THE ESC FACILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE DETAILS ON THE APPROVED PLANS. LOCATIONS MAY BE MOVED TO SUIT FIELD CONDITIONS, SUBJECT TO APPROVAL BY THE ENGINEER AND THE CITY OF KIRKLAND INSPECTOR.
18. A COPY OF THE APPROVED EROSION CONTROL PLANS MUST BE ON THE JOB SITE WHENEVER CONSTRUCTION IS IN PROGRESS.
19. ALL LOTS ADJOINING OR HAVING ANY NATIVE GROWTH PROTECTION EASEMENTS (NGPE) SHALL HAVE A 6' HIGH TEMPORARY CONSTRUCTION FENCE (CHAIN LINK WITH PIER BLOCKS) SEPARATING THE LOT (OR BUILDABLE PORTIONS OF THE LOT) FROM THE AREA RESTRICTED BY THE NGPE AND SHALL BE INSTALLED PRIOR TO ANY GRADING OR CLEARING AND REMAIN IN PLACE UNTIL THE PLANNING DEPARTMENT AUTHORIZES REMOVAL.
20. CLEARING LIMITS SHALL BE DELINEATED WITH A CLEARING CONTROL FENCE. THE CLEARING CONTROL FENCE SHALL CONSIST OF A 6-FT. HIGH CHAIN LINK FENCE ADJACENT THE DRIP LINE OF TREES TO BE SAVED, WETLAND OR STREAM BUFFERS, AND SENSITIVE SLOPES. CLEARING CONTROL FENCES ALONG WETLAND OR STREAM BUFFERS OR UPSLOPE OF SENSITIVE SLOPES SHALL BE ACCOMPANIED BY AN EROSION CONTROL FENCE. IF APPROVED BY THE CITY, A FOUR-FOOT HIGH ORANGE MESH CLEARING CONTROL FENCE MAY BE USED TO DELINEATE CLEARING LIMITS IN ALL OTHER AREAS.
21. OFF-SITE STREETS MUST BE KEPT CLEAN AT ALL TIMES. IF DIRT IS DEPOSITED ON THE PUBLIC STREET SYSTEM, THE STREET SHALL BE IMMEDIATELY CLEANED WITH POWER SWEEPER OR OTHER EQUIPMENT. ALL VEHICLES SHALL LEAVE THE SITE BY WAY OF THE CONSTRUCTION ENTRANCE AND SHALL BE CLEANED OF ALL DIRT THAT WOULD BE DEPOSITED ON THE PUBLIC STREETS.
22. ANY CATCH BASINS COLLECTING RUNOFF FROM THE SITE, WHETHER THEY ARE ON OR OFF THE SITE, SHALL HAVE ADEQUATE PROTECTION FROM SEDIMENT. CATCH BASINS DIRECTLY DOWNSTREAM OF THE CONSTRUCTION ENTRANCE OR ANY OTHER CATCH BASIN AS DETERMINED BY THE CITY INSPECTOR SHALL BE PROTECTED WITH A "STORM DRAIN PROTECTION INSERT" OR EQUIVALENT.
23. THE WASHED GRAVEL BACKFILL ADJACENT TO THE FILTER FABRIC FENCE SHALL BE REPLACED AND THE FILTER FABRIC CLEANED IF IT IS NONFUNCTIONAL BY EXCESSIVE SILT ACCUMULATION AS DETERMINED BY THE CITY OF KIRKLAND. ALSO, ALL INTERCEPTOR SWALES SHALL BE CLEANED IF SILT ACCUMULATION EXCEEDS ONE-QUARTER DEPTH.
24. ROCK FOR EROSION PROTECTION OF ROADWAY DITCHES, WHERE REQUIRED, MUST BE OF SOUND QUARRY ROCK, PLACED TO A DEPTH OF 1' AND MUST MEET THE FOLLOWING SPECIFICATIONS: 4"-8" ROCK/40%-70% PASSING; 2"-4" ROCK/30%-40% PASSING; AND 1"-2" ROCK/10%-20% PASSING.
25. IF ANY PART(S) OF THE CLEARING UNIT BOUNDARY OR TEMPORARY EROSION/SEDIMENTATION CONTROL PLAN IS/ARE DAMAGED, IT SHALL BE REPAIRED IMMEDIATELY.
26. ALL PROPERTIES ADJACENT TO THE PROJECT SITE SHALL BE PROTECTED FROM SEDIMENT DEPOSITION AND RUNOFF.
27. DO NOT FLUSH CONCRETE BY-PRODUCTS OR TRUCKS NEAR OR INTO THE STORM DRAINAGE SYSTEM. IF EXPOSED AGGREGATE IS FLUSHED INTO THE STORM SYSTEM, IT COULD MEAN RE-CLEANING THE ENTIRE DOWNSTREAM STORM SYSTEM, OR POSSIBLY RE-LAYING THE STORM LINE.
28. PRIOR TO THE OCTOBER 1 OF EACH YEAR (THE BEGINNING OF THE WET SEASON), ALL DISTURBED AREAS SHALL BE REVIEWED TO IDENTIFY WHICH ONES CAN BE SEEDED IN PREPARATION FOR THE WINTER RAINS. THE IDENTIFIED DISTURBED AREA SHALL BE SEEDED WITHIN ONE WEEK AFTER OCTOBER 1. A SITE PLAN DEPICTING THE AREAS TO BE SEEDED AND THE AREAS TO REMAIN UNCOVERED SHALL BE SUBMITTED TO THE PUBLIC WORKS CONSTRUCTION INSPECTOR. THE INSPECTOR CAN REQUIRE SEEDING OF ADDITIONAL AREAS IN ORDER TO PROTECT SURFACE WATERS, ADJACENT PROPERTIES, OR DRAINAGE FACILITIES.
29. IF A SEDIMENT POND IS NOT PROPOSED, A BAKER TANK OR OTHER TEMPORARY GROUND AND/OR SURFACE WATER STORAGE TANK MAY BE REQUIRED DURING CONSTRUCTION, DEPENDING ON WEATHER CONDITIONS.
30. ANY AREA TO BE USED FOR INFILTRATION OR PERVIOUS PAVEMENT (INCLUDING A 5-FOOT BUFFER) MUST BE SURROUNDED BY SILT FENCE PRIOR TO CONSTRUCTION AND UNTIL FINAL STABILIZATION OF THE SITE TO PREVENT SOIL COMPACTION AND SILTATION BY CONSTRUCTION ACTIVITIES.

No.	Date	By	Ckd.	Appr.	Revision
1	10/14/14	MFB	AS	AS	PRELIMINARY DESIGN CONCEPT

Title: TEMPORARY EROSION/SEDIMENT CONTROL PLAN
ASTRONICS NORTH BUILDING ADDITION

For: ASTRONICS
12950 WILLOWS ROAD N.E.
KIRKLAND, WA 98034
TIM BORLAND (425) 556-4536

BARGHAUSEN CONSULTING ENGINEERS, INC.
18215 72ND AVENUE SOUTH
KENT, WA 98032
(425)251-6222
(425)251-8782 FAX
CIVIL ENGINEERING, LAND PLANNING, SURVEYING, ENVIRONMENTAL SERVICES

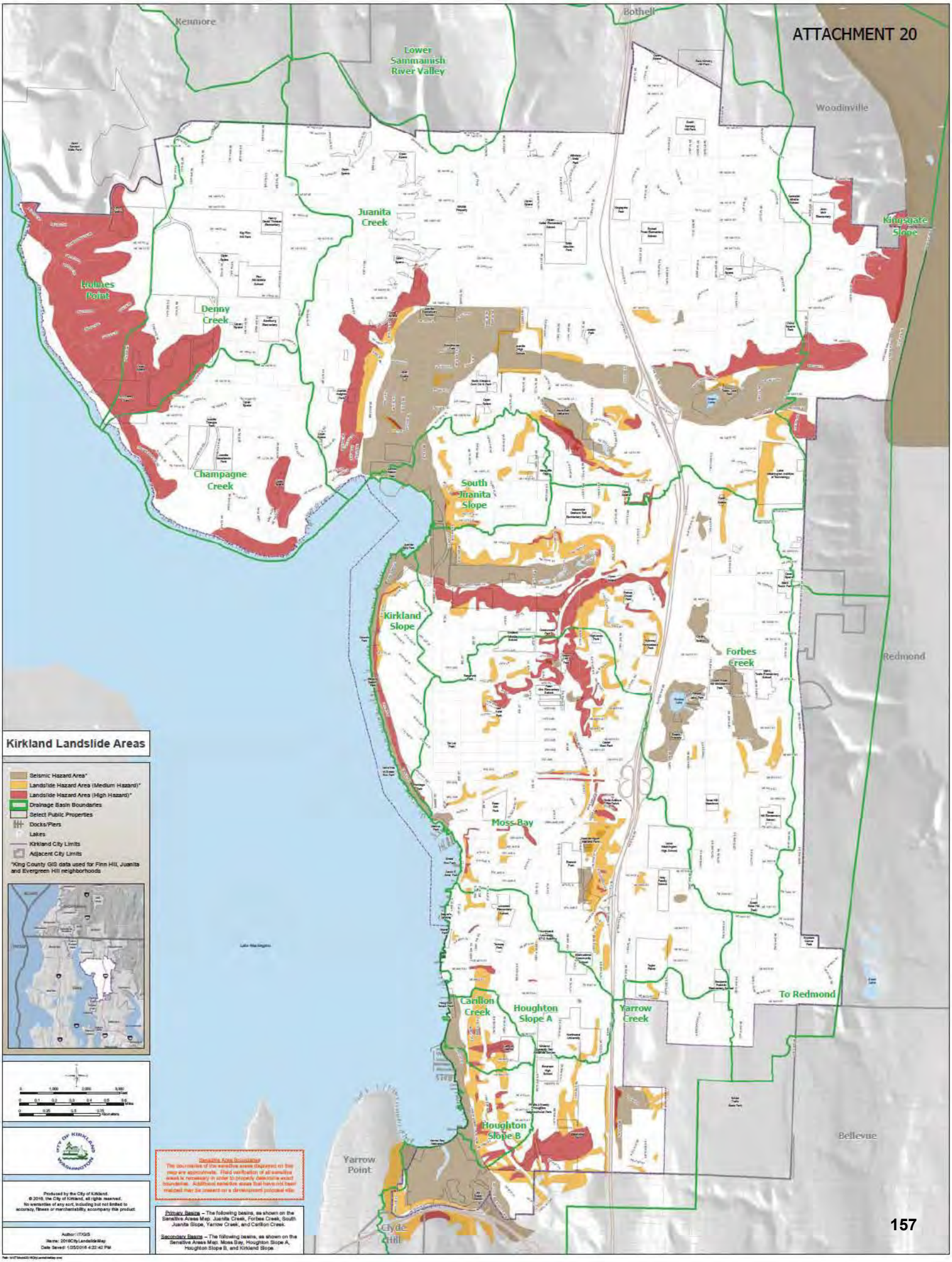
Designed AS | Drawn MFB | Checked AS | Approved AS | Date 8/04/14

Scale: Horizontal 1"=40' | Vertical N/A

Job Number 16380 | Sheet C3 of 9

File:P:\16000s\16380\engineering\NORTH BLDG\16380-E.dwg Date/Time:3/17/2015 10:00 AM Scale:1" = 1' MYORK Xref: -----

ATTACHMENT 20



Earth Solutions NW LLC

Geotechnical Engineering
Geology
Environmental Scientists
Construction Monitoring

2005 EARTH SOLUTIONS NW 10 YEARS OF EXCELLENCE BELLEVUE, WA. 2015

GEOTECHNICAL ENGINEERING STUDY
ASTRONICS - PROPOSED NORTH BUILDING ADDITION
12950 WILLOWS ROAD NORTHEAST
KIRKLAND, WASHINGTON

ES-0736.10

1805 - 136th Place N.E., Suite 201 Bellevue, WA 98005
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

ASTRONICS

March 13, 2015

Raymond A. Coglas, P.E.
Principal

GEOTECHNICAL ENGINEERING STUDY
ASTRONICS - PROPOSED NORTH BUILDING ADDITION
12950 WILLOWS ROAD NORTHEAST
KIRKLAND, WASHINGTON

ES-0736.10

Earth Solutions NW, LLC
1805 – 136th Place Northeast, Suite 201, Bellevue, Washington 98005
Ph: 425-449-4704 Fax: 425-449-4711
Toll Free: 866-336-8710

Important Information About Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* —should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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IIGER06045 0M

Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

March 13, 2015
ES-0736.10

Astronics
12950 Willows Road Northeast
Kirkland, Washington 98034

Attention: Mr. Timothy Borland

Dear Mr. Borland:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled Geotechnical Engineering Study, Astroncis - Proposed North Building Addition, 12950 Willows Road Northeast, Kirkland, Washington". This report presents the results of our geotechnical engineering study for the proposed office building and associated parking garage development.

The addition of a new office building and parking structure is currently proposed throughout the northerly parcels of the Astronics property. The primary geotechnical considerations with respect to the proposed development are related to foundation support and minimizing post-construction settlement of the new building structures. Based on review of the current plans, the first floor level of the proposed office building structure will be approximately elevation 51.0 feet. The northerly garage structure will have a finish floor (southeast corner) of approximately elevation 45.5 feet. Subsurface conditions encountered at the boring and test pit locations reveal native and existing fill deposits consisting primarily of loose to medium dense silt, silty sand and poorly graded sand deposits extending to varying depths. Interbedded deposits of clay are also present. In this respect, the native and existing fill deposits (near surface) can be characterized as having a relatively poor capacity for foundation bearing. As such, the use of aggregate pier foundations is recommended in this study for purposes of developing sufficient bearing capacity below the proposed building structures.

Recommendations for foundation design, aggregate piers, site preparation, subsurface drainage and other pertinent geotechnical recommendations are provided in this geotechnical engineering study. The opportunity to be of service to you is appreciated. If you have any questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Raymond A. Coglas, P.E.
Principal

1805 - 136th Place N.E., Suite 201 • Bellevue, WA 98005 • (425) 449-4704 • FAX (425) 449-4711

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ES-0736.10

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GEOTECHNICAL ENGINEERING STUDY
ASTRONICS - PROPOSED NORTH BUILDING ADDITION
12950 WILLOWS ROAD NORTHEAST
KIRKLAND, WASHINGTON

ES-0736.10

INTRODUCTION

General

This geotechnical engineering study was prepared for the proposed Astronics – North Building Addition to be located within the northerly parcels of the current Astronics property (12950 Willows Road Northeast, Kirkland, Washington). The location of the property is illustrated on the Vicinity Map included as Plate 1 of this study. Our scope of services for completing this geotechnical engineering study included the following:

- Recent subsurface investigation and review of previous subsurface data for the purpose of characterizing the site geologic conditions;
- Preparing excavation and earthwork recommendations, including recommendations for temporary slopes, site grading, and backfill, as appropriate;
- Providing foundation and allowable soil bearing capacity recommendations, and an assessment of anticipated construction and post-construction foundation settlements;
- Assessing the on-site soils and suitability for use as structural fill;
- Assessing groundwater levels and providing an assessment of site liquefaction susceptibility;
- Assessing possible geologic hazards and measures for mitigating any identified hazards;
- Providing pavement design recommendations, and;
- Providing additional geotechnical recommendations, as appropriate.

The following documents were reviewed as part of preparing this preliminary geotechnical engineering study:

- Preliminary Site Plan prepared by Craft Architects;
- Preliminary Survey and Site Plans prepared by Barghausen Consulting Engineers;
- City of Kirkland Code – Geologically Hazardous Areas (Ch. 85);
- King County IMap online property resource;
- Composite Geologic Map of King County, Washington Booth et al, 2006, and;
- King County Soil Conservation Survey (NRCS).

Project Description

The addition of a new two to three-story office building and parking structure is currently proposed throughout the northerly parcels of the Astronics property. The approximate building footprint areas are illustrated on the Boring and Test Pit Location Plan (Plate 2). Based on proposed finish grades, the multi-story office building and garage structures will likely incorporate east-facing daylight basement levels. The approximate finish floor elevation of the daylight level for the office building will be on the order of elevation 51.0 feet. At the back of the office building (west side), access to the second floor level will be established at approximately elevation 69.0 feet. Finish floor for the proposed garage structure will be somewhat lower than the office building, with the lowest elevation estimated at elevation 45.5 feet at the southeast corner of the structure.

The buildings will likely consist of a combination of concrete tilt-up, post-tensioned slabs, and light weight framing. The parking garage structure is expected to consist primarily of cast-in-place concrete elements and post-tensioned slabs. Column loads for the proposed office and garage structures are estimated to be on the order of 350 to 750 kips, with the higher loading being attributed to the garage structure. Perimeter wall loads are estimated to be on the order of four to 5 to 8 kips per lineal foot.

Structural fill placement of up to approximately 10 to 12 feet will likely be needed throughout the easterly sides of the property to establish the pad elevations and frontage access roadway. A retaining wall will likely be utilized along the east property boundary to support the structural fills. To establish the basement levels for the proposed buildings along the west, cuts on the order of 8 to 12 feet below existing grades will likely be necessary. Temporary open-cut excavations or shoring will be utilized to construct the excavations. To the west of the proposed building envelopes, cuts on the order of 8 to 12 feet will also likely be necessary to construct the upper paved parking and drive areas behind the buildings. Consistent with the existing Astronics development to the south, rockeries will be utilized along the west margins of the development area to support the proposed pavement area cuts.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations in this report. ESNW should review the final design to verify that our geotechnical recommendations have been incorporated into the design.

SITE CONDITIONS

Surface

The subject property is located at the northern terminus of 141st Avenue Northeast just north of the intersection of Willows Road Northeast and 141st Avenue Northeast in Kirkland, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map) included in this study. The site is roughly rectangular in shape with a gross area of approximately six acres. The site is bordered to the east and west by railroad tracks (BNSF right-of-way) and to the north and south by undeveloped parcels. The approximate limits of the property are illustrated on Plate 2 (Boring and Test Pit Location Plan) included in this study. The site is currently undeveloped.

The topography across the development portions of the site gently descends to the east with several relatively level benched areas trending roughly north-south extending the length of the property. More steeply sloping areas are present to the west of the planned development areas. There is approximately 40 to 60 feet of elevation change across the site (east-west between property lines). There is a steep elevation change descending from the western railroad tracks with the site leveling out before it descends again to the railroad tracks located east of the site. In general, it appears the central and eastern portions of the property have been modified and altered to varying degrees as a result of previous development and grading activities.

It appears as part of previous development activities on the site, a series of drainage ditches have been established. Areas of runoff, and possible seepage from the topographically higher west side of the property are being collected to varying degrees at some locations across the site. Vegetation throughout the majority of the site is varied, consisting of areas of mature evergreen trees and field grass. Portions of the site were previously used as a soil stockpile storage area during the prior (south) development activities (current Astroncis building site).

Cross Sections

For preliminary design purposes, two representative cross sections (A-A' and B-B') were developed through the building sites. The cross sections are provided on Plate 3 of this study. The cross sections do not fully depict the variations in existing surface topography and related features. However, the cross sections provide a reasonable representation of the proposed building levels relative to existing grade. The cross sections also approximately depict the areas where cuts and fills will be needed to establish the lower and upper paved parking and drive areas to the east and west of the building sites.

Subsurface

Six borings were drilled and twelve test pits were excavated across the site for purposes of assessing soil conditions, and for purposes of characterizing and classifying the site soils. Please refer to the boring and test pit logs provided in Appendix A for a more detailed description of the subsurface conditions.

Previous fill stockpiles and grading activities throughout the central and west portions of the property have produced areas of existing fill. From observations and subsurface investigations, the existing fill depths range between approximately 6 to 18 feet. The existing fill material consist primarily of loose silty sand and silt soils with occasional gravel.

In general, underlying the existing fill, the subsurface investigations revealed a varied sequence of sandy silt (Unified Soil Classifications ML), silt (ML), lean clay (CL), silty sand (SM), silty sand with gravel (SM), and poorly graded sand (SP). These deposits generally increased in relative density (or consistency) with depth. However, in general, the upper 10 to 20 feet of the soil deposits throughout the site are characterized as variable with respect to soil relative density (or consistency). This variability is an important consideration with respect evaluating soil bearing capacity and post-construction settlement potential (as discussed later in this study).

Geologic Setting

Based on review of the previously referenced Geologic Map of King County, it glacial till (Qvt) advance sand (Qva) and pre-Fraser (fine grained) deposits are mapped throughout much of the site and surrounding areas. Review of the Soil Survey of King County (NRCS) indicates the presence of Everett Gravelly Sandy Loam (EvC) deposits throughout the north and central portions of the site and surrounding areas. To the west and south of the subject site, deposits of Alderwood Gravelly Sandy Loam (AgD 15 to 30 percent slopes) are identified. Based on our findings at the test sites, Alderwood and Everett type soils underlain with finer grained silt and clay deposits were primarily encountered. Based on the soil conditions encountered during our fieldwork, the native soils are generally consistent with the geologic designations and the NRCS characterization.

Groundwater

The groundwater table was observed in borings B-103 and B104 at a depth of approximately 28.5 feet below existing grade at the time of our fieldwork (March, 2007). Subsequent boring investigations completed in February 2015 did not identify groundwater conditions at-depth. However, the presence of shallower zones of groundwater seepage should be expected in the site excavations. In general, significantly deep building pad cuts are not proposed for this project. In this respect, we anticipate groundwater seepage conditions exposed during excavation for the building sites can be managed through standard construction technicques (sumps / interceptor trenches). However, efforts to collect surface water runoff and possible shallow groundwater seepage throughout the topographically higher west portions of the site should be evaluated prior to major grading activities. Runoff from the topographically higher areas to the west of the site could impact the development areas if provisions to collect this runoff are not further assessed and mitigated, as necessary. It is also important to note that groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months.

CRITICAL AREAS REVIEW

As part of our report preparation, we reviewed Chapter 85 of the City of Kirkland Zoning Code (Geologically Hazardous Areas) to assess if any potential critical areas, that meet current critical area definitions, are present on the subject site, and to provide recommendations for mitigating soil instability or excessive erosion, as appropriate. As part of our review, the King County I-Map resource was also reviewed.

Seismic Hazard Area Assessment

Based on our review of the referenced IMap online resource, seismic hazard areas are identified across the extreme westerly portions the subject property. The subject property is located topographically higher than the Sammamish Valley floor located immediately to the east of the property. In general, the liquefaction susceptibility of the Sammamish Valley area would be characterized as moderate to high. However, based on the subsurface conditions encountered at the test sites throughout the subject property, we would characterize the liquefaction susceptibility of the native soils as low.

Landslide Hazard Area Assessment

Based on our overall review of the City of Kirkland and King County I-Map online resources, landslide hazard areas are identified directly west of the subject property. Based on site reconnaissance, the primary hazard with respect to landslide activity would be associated with areas to the west of the site (directly above and below the existing railroad alignment). No evidence of large scale slope movements or landslide activity was observed as part of our investigation. With respect to the proposed development activities, the majority of the planned activity along the west side of the site will consist of retaining wall construction and related drainage improvements. In this respect, based on our review and involvement with the previous development to the south (existing Astroncis buildings), the planned development activities will likely decrease the potential for slope instability of the site slopes due to the improved soil retention and drainage. ESNW should review the final site grading plans to confirm that appropriate site development methods are incorporated into site designs and to provide additional geotechnical recommendations, as appropriate.

Erosion Hazard Area Assessment

Based on our review of the referenced map resources, erosion hazard areas are identified directly west of the subject property. In our opinion, the site soils would present a moderate to severe erosion hazard. Best Management Practices (BMPs) consistent with current code requirements should be incorporated into final site designs. At a minimum, silt fencing should be placed along the entire down-slope development envelope. Construction entrances should be surfaced with quarry spalls to minimize off-site tracking of silt and soil generated during site construction. ESNW should review the proposed Temporary Erosion and Sedimentation Control (TESC) plans to see that appropriate means of controlling off-site sedimentation are implemented and to provide supplemental recommendations, as necessary. Final design plans should properly accommodate stormwater runoff and direct it away from the slopes or into a properly designed collection system.

DISCUSSION AND RECOMMENDATIONS

General

In our opinion, the planned office building and garage structure development is feasible from a geotechnical standpoint. The primary geotechnical considerations with respect to the planned development activities are related to foundation support and minimizing post-construction settlements. Although the native soil deposits can be characterized as having a relatively low capacity for compression, unacceptable settlement of these deposits could occur as the office building and garage structure foundation loads are applied. As such, the use of aggregate pier foundations is recommended in this study for purposes of developing sufficient bearing capacity (at-depth), and for purposes of minimizing post-construction settlements. Recommendations for aggregate piers and foundations are discussed in the *Foundations* section of this study. In our opinion, the lower basement levels for the office building and garage structure can be constructed as a slab-on-grade without aggregate pier support, provided the slabs are supported on a compacted structural fill base.

Site drainage will need to be addressed prior to the grading activities and fill placement to ensure runoff and seepage zones are controlled and directed around the building sites, where necessary. Recommendations for foundation design, site preparation, subsurface drainage and other pertinent geotechnical recommendations are provided in this preliminary geotechnical engineering study.

This geotechnical engineering study has been prepared for the exclusive use of Astronics and their representatives. The study has been prepared specifically for the subject project. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

The primary considerations with respect to earthwork are related to the cuts and structural fill placement throughout the proposed building and pavement areas. As previously discussed, fills up to approximately 10 to 12 feet are anticipated throughout the easterly portions of the site to establish the site frontage road and adjacent easterly sides of the building pads. It should be noted that fills directly within the building footprint areas will likely be limited to roughly 4 feet. Along the east property line, retaining walls will likely support the structural fill and new pavement and drive areas. Immediately to the west of the new building structures, structural fill placement of up to approximately 10 feet will also likely be necessary to support new pavement areas and access to the structures. With respect to cuts, excavations on the order of 10 to 12 feet are expected throughout the westerly areas of the building sites and along the west margins of the upper parking areas.

Structural Fill Material

The existing fill and native soil deposits expected to be encountered throughout the planned excavations may be feasible for use as structural fill depending on the proposed application and moisture content at the time of construction. In general, the existing fill and fine grain native soils should not be considered for use directly below the proposed building structures. The geotechnical engineer, however, should evaluate the suitability of the onsite soils for use as structural fill on a case by case basis at the time of construction.

Imported soil intended for use as structural fill should consist of a suitable well-graded granular soil with a moisture content that is at or near the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well graded granular soil with a fines content of 5 percent or less defined as the percent passing the #200 sieve, based on the minus three-quarters inch fraction. The geotechnical engineer should evaluate the proposed structural fill soils and provide supplement recommendations for structural fill, as appropriate.

Based on the results of our laboratory analyses, the existing fill and native on-site soils anticipated to be encountered in the site excavations will generally have a moderate to high sensitivity to moisture. These soils are anticipated to consist largely of silty sand and sandy silt deposits. The on-site native soils may be suitable for use as structural fill, depending on the application and moisture content at the time of placement.

Compaction Requirements

For purposes of this study, structural fill placed within the building envelopes should consist of a suitable granular soil compacted to 90 percent relative compaction. Structural fill placed throughout the planned pavement areas should consist of a suitable material compacted to a relative compaction of 90 percent, with the exception of the upper 12 inches of the subgrade, which should be compacted to a relative compaction of 95 percent. The maximum dry density should be based on the maximum dry density as determined by the Modified Proctor Method (ASTM D-1557). Structural fill soils should be placed and compacted in maximum twelve (12) inch loose lifts.

Erosion Control

Temporary erosion control should consist of conventional silt fencing along the down gradient perimeter of the development portion of the site, and temporary means to control site runoff, as appropriate, or as required by the King County development standards. During periods of extended precipitation, exposed earth surfaces should be mulched or protected by other suitable means, as appropriate, to reduce the potential for surface erosion.

Rockeries and Segmental Panel Walls

We anticipate that rockeries and segmental panel (Lock and Load) walls may be utilized at the site as part of the proposed development. In our opinion, the use of rockeries and segmental panel walls at this site is feasible from a geotechnical standpoint. Rockeries and segmental panel walls over four feet in exposed height will require an engineered design. ESNW can provide engineered rockery and segmental panel wall designs, upon request.

Foundations

Due to the loose and variable near surface soil conditions encountered at the test sites, unacceptable settlement of these upper deposits could occur as the office building foundation loads are applied. As such, the use of aggregate pier foundations is recommended in this study for purposes of developing sufficient bearing capacity and for purposes of minimizing post-construction settlements.

Aggregate Piers

Due to the loose and variable near surface soil conditions, the use of aggregate piers should be considered for support of the foundations. Aggregate piers would replace the existing near surface soils with a series of crushed rock columns. The building foundations would derive support along the crushed rock columns, mitigating the potential for excessive foundation settlements. A formal design for aggregate piers should be developed during the design phase of the project when the foundation plan and loading has been determined. In general, the following preliminary recommendations and guidelines should be incorporated into the aggregate pier design:

- Pier Diameter — 24 to 30 inches (typical)
- Pier Depth — Varies. (Estimated 12 to 25 Feet).
- Installation Method — Augered Holes. Casing used in weak or caving soils.
- Aggregate Material — Typically one to one and one-half inch crushed rock.
- Pier Spacing — Varies. Depends on soil conditions and foundation loads.
- Allowable Bearing — Assume 6,000 psf.
- Friction — Assume 0.50 (Foundation / Pier Interface)*
- Passive Pressure — Assume 350 pcf (Structural Backfill)*
- Wind and Seismic — Allowable One-Third Increase
- Total Settlement — One Inch or Less
- Differential Settlement — One-half Inch or Less (over 50 feet)
- Cost — Varies, but is typically less than piling (estimated $900/pier)

*** Includes factor-of-safety of 1.5**

Based on the subsurface conditions encountered at the boring and test pit locations, the majority of the building footprint areas will likely require aggregate piers. Areas of the building site where competent native soil deposits are encountered at the building subgrade elevations may not require the use of aggregate piers. At this time, delineation of these areas is difficult to determine. Further evaluation of the foundation subgrade conditions should be performed during the site mass grading to better determine the required extent of the aggregate pier foundations. It is possible that overexcavation and replacement could be utilized in some areas where the competent native soils are present at relatively shallow depths. Where overexcavation is determined feasible, a suitable crushed rock material should be used to backfill the excavation.

Slab-On-Grade Floors

In our opinion, the proposed garage slab areas can be constructed as a slab-on-grade, and would not require aggregate pier support. The slab-on-grade floors for the proposed buildings should be supported on compacted structural fill. Structural fill in slab-on-grade areas should consist of suitable granular soil compacted to 95 percent relative compaction. Unstable or yielding areas of the subgrade should be recompacted or overexcavated and replaced with suitable structural fill prior to construction of the slab. A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less passing the #200 sieve, based on the minus three-quarters inch fraction. In areas where slab moisture is undesirable, installation of an approved vapor barrier or membrane below the slab should be considered.

Retaining Walls

Retaining walls should be designed to resist earth pressures and any applicable surcharge loads. For design, the following parameters should be assumed for retaining wall design:

- Active Earth Pressure (Yielding Wall) — 35 pcf (equivalent fluid)
- At-Rest Earth Pressure (Restrained Wall) — 50 pcf
- Traffic Surcharge (Passenger Vehicles) — 70 psf (rectangular distribution)
- Soil Bearing Capacity — 6,000 psf (Building Foundation Wall)
- Soil Bearing Capacity — 3,000 psf (Site Retaining Wall)
- Passive Resistance — 350 pcf (equivalent fluid)
- Coefficient of Friction — 0.50 (Building Foundation Wall)
- Coefficient of Friction — 0.40 (Site Retaining Wall)

Additional surcharge loading from foundations, sloped backfill, or other loading should be included in the retaining wall design, as appropriate. Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design, as appropriate.

Retaining walls should be backfilled with free draining material that extends along the height of the wall, and a distance of at least 18 inches behind the wall. The upper one-foot of the wall backfill can consist of a less permeable (surface seal) soil, if desired. A perforated drain pipe should be placed along the base of the wall, and connected to an appropriate discharge location. A typical retaining wall drainage and backfill detail is included as Plate 4 of this study.

Seismic Considerations

The 2012 International Building Code specifies several soil profiles that are used as a basis for seismic design of structures. The 2012 IBC recognizes ASCE for seismic site class definitions. In accordance with Table 20.3-1 of ASCE, Minimum Design Loads for Buildings and Other Structures, Site Class D, should be used for design.

Liquefaction / Landslide Hazards

In our opinion, liquefaction susceptibility at this site is low. The relative density and fine grain nature of the site soils, and the absence of a uniform shallow groundwater table are the primary bases for this designation. Additionally, building foundations supported on aggregate piers or crushed rock structural fill will mitigate the potential for liquefaction related foundation settlements.

With respect to landslide hazards, the risk of impacts from seismically induced landslides initiated offsite would be characterized as low. The proposed building structures will incorporate structural foundation walls, and the development areas are sufficiently removed from the areas of landslide potential identified to the west.

Excavations and Shoring

The Federal and state Occupation Safety and Health Administration (OSHA/WISHA) classifies soils in terms of minimum safe slope inclinations. Based on conditions observed at our test sites, the loose to medium dense silt and silty sand soils in the upper approximately ten feet would be classified as Type C soils by OSHA. Type C soils should be sloped no steeper than 1.5H:1V (Horizontal:Vertical). In addition, where groundwater seepage is encountered in excavations, the soil should be characterized as Type C, and sloped no steeper than 1.5H:1V.

The dense silt and clay soils encountered below approximately ten feet would generally be classified as Type B Soils. Temporary slopes in Type B souls should be sloped at an inclination of 1H:1V or flatter. However, the geotechnical engineer should observe temporary excavations to verify the OSHA/WISHA soil type and allowable temporary slope inclination.

Permanent slopes should be sloped no steeper than 2H:1V. Permanent slopes should be mulched or vegetated with appropriate species of plants to reduce the potential for surface erosion.

Similar to the prior development to the south (existing Astronics buildings), temporary shoring may be utilized to support the west excavation for the proposed building pads. Although temporary layback of the building excavations is likely feasible, the use of temporary shoring (if desired) would serve to maintain a relatively flat grade west to the building sites during construction. This may benefit the construction process by providing a staging area and access around the site. Temporary shoring consisting of soil nailing or soldier piles can be considered, in our opinion. Other options, however, may be feasible and can be further evaluated by ESNW, if requested. Additionally, ESNW can also provide shoring design recommendations and drawings.

Drainage

The seasonal groundwater table was observed at depths of approximately 26 to 28.5 feet below existing grades at the time of our earlier fieldwork (February and March 2007). Along the west sides of the development area, cuts ranging from 10 to 12 feet will be necessary at some locations. During construction, groundwater seepage exposed in cuts will likely be manageable through standard techniques (sump pits and interceptor trenches). However, efforts to collect surface water runoff and possible shallow groundwater seepage throughout the topographically higher west portions of the site should be evaluated prior to major grading activities. Runoff from the topographically higher areas to the west of the site could impact the development areas if provisions to collect this runoff are not further assessed and mitigated, as necessary.

With respect to permanent drainage, perimeter drains should be installed at or below the invert of the building footings. Typical footing drain details for foundation walls and shallow footings are provided on Plates 4 and 5 of this report, respectively. The need for supplement permanent drainage elements should be evaluated by the geotechnical engineer during construction. If determined necessary, supplement drainage below the building slab and throughout exterior areas may be recommended based on observed and encountered conditions.

Utility Trench Backfill

In our opinion, the soils observed at the test sites are generally suitable for support of utilities. Organic or highly compressible soils encountered in the trench excavations should not be used for supporting utilities. In general, the on-site soils observed at the test sites should be suitable for use as structural backfill in the utility trench excavations, provided the soil is at or near the optimum moisture content at the time of placement and compaction. Moisture conditioning of the soils may be necessary at some locations prior to use as structural fill. Utility trench backfill should be placed and compacted to the specifications of structural fill provided in this report, or to the applicable specifications of the city jurisdictions, as appropriate. With respect to groundwater, the deeper utility trench excavations could encounter groundwater conditions.