



Dr. Marvin Silva, PhD, PE, P.Eng.
Senior Geotechnical Engineer

Education

PhD, Geotechnical/Geoenvironmental Engineering, University of Alberta, 1999
AS, Civil Engineering Technology, Northern Alberta Institute of Technology, 1991
MS, Soils and Water Resources Engineering, Institute of Odessa, Ukraine, 1985
BS, Civil/Agricultural Engineering, National Autonomous University of Nicaragua, 1981

Registrations/Certifications

Professional Engineer Arizona (#43472), Alaska (132497), Massachusetts (Inactive), Alberta (52477), British Columbia (24778)

Experience Summary

Dr. Marvin Silva is a senior geotechnical engineer with over 27 years of experience in the geotechnical engineering field. He is experienced in geotechnical studies, planning, design, and construction management for a variety of civil and mining projects at scoping, pre-feasibility, feasibility, and detail engineering level. His experience in the mining industry includes the design and construction of tailings storage facilities (TSF), waste dumps, heap leach pads (HLP), and earth and rockfill dams. He is capable of designing safe, robust, and efficient structures beginning with a comprehensive geotechnical investigation program, recommending the most appropriate laboratory testing program, and conducting seepage and slope stability analysis for static and dynamic conditions using the most advanced and state of the art geotechnical software. Dr. Silva has also experience with tailings dewatering and treatment followed by reclamation and closure. He is fluent in Spanish, has a wide range of technical knowledge and has worked on projects throughout the United States, Canada, Spain, and Latin America (Chile, Colombia, Perú, Mexico, and Nicaragua).

Dr. Silva gained a solid knowledge and understanding of the physical behavior of tailings working with this material in his doctoral research at the University of Alberta. He understands the complex large strain consolidation process of tailings and how tailings consolidate and dewater under their self-weight. Dr. Silva has experience with various modeling software including finite strain consolidation models (FSCONSOL) to predict consolidation settlement in tailings deposits; SLOPE/W, SEEP/W, SIGMA/W, VADOSE/W, and Slide software for assessing slope stability of tailings dams and waste dumps; DIPS stereonet analysis to evaluate kinematic stability of pit slopes. He recently conducted a state of knowledge review of tailings treatment (dewatering) technologies including conventional and dry stack tailings.

Project Experience

Heap Leach Pads

HLP DETAILED DESIGN PHASE 5, LA MASCOTA MINE | CHIHUAHUA, MEXICO

Senior Project Manager responsible for the design of a HLP expansion. Work included performing engineering analyses: hydrology, water balance, slope stability, and settlement. The final product was a set of Issued for Construction drawings, technical specifications, and design report. (Tierra Group, 2018)

HLP DETAILED DESIGN PHASE 3, LA TRINIDAD MINE | SINALOA, MEXICO

As Senior Project Engineer, provided technical direction to complete a detailed design of a HLP expansion. Work included guidance for an additional geotechnical investigation and laboratory testing, performing engineering analyses, preparing a set of construction drawings, technical specifications, and design report. Performed rainfall frequency analysis using data from meteorological stations near the site to verify the 100-year 24-hour storm event. The new parameter was incorporated in the HLP water balance model.

Tierra Group saved construction costs by eliminating the need for a new emergency pond. (Tierra Group, 2017)

HLP CONCEPTUAL DESIGN PHASE 3 LA INDIA MINE | SONORA, MEXICO

Senior Project Manager responsible for developing a conceptual design for a new HLP at La India Mine. Scope of work included conceptual level plans, recommendation for future geotechnical investigation, and preliminary stacking plan. (Tierra Group, 2017)

HEAP LEACH FACILITY (HLF) THIRD PARTY REVIEW, AMULSAR MINE | ARMENIA

As Senior Geotechnical Engineer, conducted a technical review of a design report, engineering analyses, and construction level drawings to identify deficiencies and opportunities for improvement. Documented findings and provided recommendations in a final report. (Tierra Group, 2017)

HLF TECHNICAL PEER REVIEW, ISABELLA PEARL MINE | NEVADA

As Senior Project Engineer, provided peer review of heap leach design to ensure the proposed design is adequate; identifying opportunities to improve the design to potentially reduce capital and operating costs; and identifying associated risks with implementing optimization. (Tierra Group, 2016)

HLP CONSTRUCTION PHASE 4, LA MASCOTA MINE | CHIHUAHUA, MEXICO

As Senior Project Manager, provided senior engineering review and oversight of quality assurance/quality control (QA/QC) program for the construction of a new HLF. Responsible for approving design changes in accordance with changes in site conditions. (Tierra Group, 2016)

DETAIL DESIGN OF HLF PHASE 4, LA MASCOTA MINE | CHIHUAHUA, MEXICO

As Senior Project Manager, provided project management and technical direction for a HLF expansion design. Performed slope stability analysis, stormwater management, water balance, specifications, and provided senior review of engineering drawings. (Tierra Group, 2016)

WATER BALANCE UPDATE OF PREGNANT AND EMERGENCY PONDS, LA INDIA MINE | SONORA, MEXICO

Senior Technical Reviewer responsible for gathering new site data and updating the water balance. The water balance model was calibrated with existing data and dates were predicted when the existing ponds will overflow. The results of the model will help the client to decide on when to construct a new emergency pond. (Tierra Group, 2015)

DETAIL DESIGN OF HLF PHASE 2, MINA LA INDIA | SONORA, MEXICO

As Senior Project Manager, directed the design team to conduct a detail design of a HLF. Providing senior review of engineering calculations, drawings, and specifications. (Tierra Group, 2015)

GEOTECHNICAL INVESTIGATION FOR HLF PHASE 4, LA MASCOTA MINE | CHIHUAHUA, MEXICO

Senior Project Manager responsible for conducting geotechnical investigation, directing laboratory testing, and conducting engineering analysis including slope stability analysis (SLOPE/W), seepage analysis (SEEP/W), and settlement analysis using SIGMA/W software. (Tetra Tech, 2014)

HLP CONSTRUCTION, MINA LA INDIA | SONORA, MEXICO

As Senior Project Manager, provided senior engineering review and oversight of quality assurance/quality control (QA/QC) program for the construction of a new valley-fill type HLF. Responsible for approving design changes in accordance with changes in site conditions. (Tierra Group, 2015)

DETAIL DESIGN OF HLF PHASE 3, MINA LA MASCOTA | CHIHUAHUA, MEXICO

As Senior Project Manager, directed the design team to conduct a detail design of HLF. Providing senior review of engineering calculations, drawings, and specifications. The project included a geotechnical investigation, a geophysical survey using the seismic refraction method, and developing a laboratory testing program. (Tetra Tech, 2014)

PRE-FEASIBILITY LEVEL DESIGN OF BREWERY CREEK HLF | YUKON, CANADA

Senior Project Manager in charge of the design of a HLF. Low permeability soil was limited at the site and a geosynthetic clay liner (GCL) material was recommended to be used below the geomembrane. Due to the low shear strength properties of the GCL, a containment dike was designed downstream to provide additional stability of the heap. Project included conducting slope stability analysis, water balance, pond sizing, design of diversion channels, and stacking plan. (Tetra Tech, 2013)

GEOTECHNICAL INVESTIGATION FOR HEAP LEACH DESIGN | MESQUITE, CALIFORNIA

Project Engineer responsible for conducting geotechnical investigation, directing laboratory testing, and conducting engineering analysis including slope stability analysis (SLOPE/W), seepage analysis (SEEP/W), and settlement analysis using Settle3D software. Laboratory tests included direct shear test of the clay, interface direct shear, puncture tests, and permeability test of the ore. (Tetra Tech, 2011 to 2012)

SLOPE STABILITY ANALYSIS OF ONGOING CONSTRUCTION OF HLP | AGNICO EAGLE, MEXICO

Project Engineer responsible for conducting slope stability analysis (SLOPE/W), seepage analysis (SEEP/W), and settlement analysis using Settle3D software to verify the stability of the as-built HLP. (Tetra Tech, 2011 to 2012)

SETTLEMENT ANALYSIS FOR HEAP LEACH DESIGN FEASIBILITY LEVEL | YUKON, CANADA

Project Engineer responsible for conducting settlement analysis using Settle3D software to determine differential settlement and to check the maximum elongation expected in the geomembrane. (Tetra Tech, 2011 to 2012)

HEAP LEACH DESIGN PRE-FEASIBILITY LEVEL | ONTARIO, CANADA

Project Manager responsible for the design of the HLF including geotechnical investigation, laboratory testing, design of liner system, design of the solution and event ponds, design of diversion channels, sizing collection pipes. Also, responsible for slope stability, seepage, and settlement analyses. (Tetra Tech, 2012)

HEAP LEACH DESIGN FEASIBILITY LEVEL | ROSEMONT, ARIZONA

As Project Engineer, conducted geotechnical investigation, directing laboratory testing, and performed engineering analysis including slope stability analysis (SLOPE/W), seepage analysis (SEEP/W), and settlement analysis using Settle3D software. Laboratory tests included direct shear test of the clay, interface direct shear, puncture tests, and permeability test of the ore. (Tetra Tech, 2011)

Mine Tailings / Waste Facilities

INDEPENDENT TAILINGS REVIEW BOARD (ITRB), QUINSAM COAL | BRITISH COLUMBIA, CANADA

As Senior Geotechnical Engineer, performed a review of existing design reports and construction drawings. Performed a site visit along with other members of the ITRB to inspect the tailings dam. ITRB prepared a report providing recommendations to the client. (Tierra Group, 2018)

ANNUAL TAILINGS DAM INSPECTION, EL LIMON AND LA LIBERTAD MINES | NICARAGUA

Conducted annual inspection of four tailings dams in Nicaragua. Work included reviewing the most recent monitoring reports and visual inspection of the dams and auxiliary structures. Prepared a written dam inspection trip report and provided recommendations to the client. (Tierra Group, 2017)

GEOTECHNICAL INVESTIGATION LOS GATOS TSF AND PLANT SITE | CHIHUAHUA, MEXICO

As Senior Geotechnical Engineer, led the geotechnical investigation program which included diamond rock core drilling, test pit excavations, and geophysical survey at the proposed TSF and plant site locations. Prepared geotechnical report providing footing recommendations for the plant site facilities and foundation recommendations for the proposed rockfill dam. (Tierra Group, 2017)

DRY STACK TAILINGS FACILITY MONITORING PROGRAM, EL LIMON GUAJES MINE | GUERRERO, MEXICO

Senior Geotechnical Engineer responsible for geotechnical monitoring program which included activities related to the geotechnical field campaign, laboratory testing and results associated to the samples collected during the field campaign. Performed liquefaction potential evaluation and slope stability analysis using parameters obtained from field and laboratory test results. (Terra Group, 2016)

NYRSTAR TAILINGS STEWARDSHIP, TENNESSEE MINES | USA

Project Manager and reviewer of design reports, construction reports, OMS (Operations, Maintenance, and Surveillance) Manual, water balance, annual audit reports, site risk assessment, monitoring reports, emergency action plan and other relevant information as part of the Dam Safety Review. Conducted dam inspection and prepared a dam safety review report. (Tierra Group, 2016)

NYRSTAR TAILINGS STEWARDSHIP, MYRA FALLS | USA

Project Manager and reviewer of design reports, construction reports, OMS Manual, water balance, annual audit reports, site risk assessment, monitoring reports, emergency action plan and other relevant

information as part of the Dam Safety Review. Performed a dam safety inspection and prepared (draft) dam safety review report. (Tierra Group, 2016)

NYRSTAR TAILINGS STEWARDSHIP, CAMPO MORADO | MEXICO

Project Manager and reviewer of design reports, construction reports, OMS Manual, water balance, annual audit reports, site risk assessment, monitoring reports, emergency action plan and other relevant information as part of the Dam Safety Review. Conducted dam inspection and prepared a dam safety review report. (Tierra Group, 2016)

GOLDCORP TAILINGS STEWARDSHIP, CERRO NEGRO | ARGENTINA

Provided technical assistance as part of the Dam Safety Review. (Tierra Group, 2016)

GOLDCORP TAILINGS STEWARDSHIP, MARLIN MINE | GUATEMALA

Provided technical assistance as part of the Dam Safety Review. (Tierra Group, 2015)

GOLDCORP TAILINGS STEWARDSHIP, PEÑASQUITO | MEXICO

Provided technical assistance as part of the Dam Safety Review. (Tierra Group, 2015)

DRY STACK TAILINGS FACILITY EVALUATION AND ANALYSIS, PINOS ALTOS MINE | CHIHUAHUA, MEXICO

Senior Geotechnical Engineer responsible for conducting an evaluation of the functionality and stability of a proposed dry stack tailings facility. Performed slope stability analysis and stormwater management calculations to determine size of contact water collection pond. (Tierra Group, 2015)

PRE-FEASIBILITY LEVEL DESIGN OF TSF STARTER DAM, FRONTERA MINING CORP. | SONORA, MEXICO

Senior Geotechnical Engineer and Reviewer of the design of the starter dam for the Piedras Verdes project located in Sonora, Mexico. The project included preparation of pre-feasibility level drawings, preliminary hydrology, water balance, specifications, and cost estimate. (Tetra Tech, 2015)

WATER BALANCE UPDATE TO ESTIMATE DATE OF CONSTRUCTION OF SECOND PHASE OF DAM, FRONTERA COPPER | MEXICO

As Senior Technical Reviewer, conducted a site visit, gathered new site data, and updated the water balance using GoldSim software. The water balance model was calibrated with existing data and a date was predicted when the existing starter dam will reach full capacity. (Tetra Tech, 2014 to 2015)

DETAIL LEVEL DESIGN OF TSF, FRONTERA COPPER | MÉXICO

Project Geotechnical Engineer responsible for all technical aspects of the design including site investigation, interpretation of laboratory test results, seepage and slope stability analysis, preparation of specifications, and writing report. (Tetra Tech, 2011)

WASTE ROCK DUMP DESIGN | SILVER BELL, ARIZONA

Project Engineer responsible for the design of a new waste rock dump facility at the Silver Bell Mine. Work included slope stability and seepage analyses, stormwater control plan, geochemical characterization, and closure strategy. The stability analysis was performed using SLOPE/W and the seepage analysis was performed using VADOSE/W, both components of the GeoStudio 2007 software package. (Tetra Tech, 2011)

PRE-FEASIBILITY LEVEL DESIGN OF TSF | ALBERTA, CANADA

Project Manager responsible for the design of a TSF including site selection, development of design criteria, design of a zoned dam, diversion ditches, and underdrain and seepage collection system. (Tetra Tech, 2010)

WASTE ROCK DUMP DESIGN, VENTANA GOLD | COLOMBIA

Project Manager responsible for the design of the waste rock dumps including site selection, development of design criteria, diversion ditches, and underdrain and seepage collection system. (Tetra Tech, 2010 to 2011)

In-Pit Tailings Storage Facilities

CAMECO CORPORATION, RABBIT LAKE OPERATIONS | SASKATCHEWAN

Senior Geotechnical Engineer responsible for the design of the pervious surround for the proposed North Pit Expansion of the existing Rabbit Lake In-Pit Tailings Management Facility. Work included the development of the design criteria, pit design, slope stability analysis and the filter zone design for the pervious surround. The slope stability included the pit stability using rock mechanics and pervious surround stability using soil mechanics. The pervious surround consisted of several permeable layers with the ultimate goal of providing a seepage path for water during tailings placement, facilitating the dissipation of excess pore water pressure and promoting the consolidation of the tailings under self-weight. (Tetra Tech, 2011)

AMERICAN MANGANESE, ARTILLERY PEAK PRE-FEASIBILITY LEVEL DESIGN OF FILTERED (DRY STACK) TAILINGS CO-DISPOSAL | ARIZONA

Project Manager responsible for the design of the temporary TSF mixed with waste rock and future backfilling of the open pit. Work included laboratory testing of tailings and engineering analysis to design safe slopes for the co-disposal stockpiles. Qualified Person (QP) for writing the tailings, waste rock, and site water management sections of the NI43-101 report. (Tetra Tech, 2011)

Reclamation and Closure of Mine Waste Facilities

RECLAMATION AND CLOSURE OF TAILINGS POND, SUNCOR | ALBERTA, CANADA

Conducted geotechnical investigation to determine stratigraphy and engineering properties of the tailings. Areas of soft tailings were dewatered by mechanical and hydraulic methods. Participated in the design of stable landforms using geomorphological principles combining surface hydrology and erosion control measures. Designed liner and soil cover with adequate depth to provide a store and release function. (BGC Engineering, 2010)

TAILINGS MANAGEMENT AND CLOSURE PLAN, TOTAL E&P CANADA | ALBERTA, CANADA

Geotechnical Engineer responsible for conducting consolidation modeling of future soft tailings using finite strain consolidation models (FSCONSOL) to predict settlement of proposed tailings deposits. This work was part of a tailings management plan and closure application which included design of final landform, hydrology, consolidation, and closure plans. Work performed also included hydrological analysis of the initial and final topography to determine flows for the 100-year storm event and the Probable Maximum Flood (PMF) event and design of erosion control measures to reduce/eliminate erosion. (BGC Engineering, 2009)

Geologic Studies / Hazard Investigations

GEOLOGICAL AND SEISMIC HAZARD EVALUATION, WILDCAT SILVER | ARIZONA

Conducted seismic hazard analysis using deterministic and probabilistic methods to determine the peak ground acceleration (PGA) associated with the maximum credible earthquake (MCE) and maximum probable earthquake (MPE) to be used in the design of mine facilities including tailings dams and waste rock dumps. Geological hazard evaluation included rock fall hazard, land subsidence, soil collapse potential, and soil expansion potential. (Tetra Tech, 2012)

SEISMIC HAZARD EVALUATION, ORACLE RIDGE | ARIZONA

Conducted seismic hazard analysis using deterministic and probabilistic methods to determine the PGA associated with the MCE and MPE to be used in the design of mine facilities including tailings dams and waste rock dumps. (Tetra Tech, 2011)

Mine Geotechnical

PLANT SITE GEOTECHNICAL INVESTIGATION, BARRICK GOLD CORPORATION | CERRO CASALE, CHILE

Project Engineer responsible for conducting test fill pads to determine suitability of in-situ material to be used as engineered fill for foundations of heavy civil structures at the proposed mine plant site. Participated in meetings with clients, resolved communication conflicts, and provided technical oversight of the project. (BGC Engineering, 2010)

IN-PIT DYKE DESIGN, SHELL ALBIAN SANDS | ALBERTA, CANADA

Project Engineer responsible for designing in-pit dykes to retain mine waste fluid tailings. Design included subsoil investigation, evaluation of in-situ material to determine its suitability for dyke core and shell construction. Design of chimney drain. Seepage and slope stability analysis using SLOPE/W and SEEP/W computer software. Preparation of construction documents, drawings, and specifications. Monitored construction activities using data from installed instrumentation (inclinometers, piezometers) and from field hydraulic conductivity tests. (BGC Engineering, 2009 to 2010)

DEWATERING OF MINE TAILINGS, PHD RESEARCH, UNIVERSITY OF ALBERTA | CANADA

Conducted doctoral research that studied and evaluated the strength enhancement mechanism of suitable plant species growing on high water content mine waste tailings. Evaluated the soil shear strength increase due to root reinforcement and matric suction. Measured bearing capacity using the plate load test method using computer data-loggers recording applied forces and deformations. Developed a unique computer simulation model capable of predicting water content and soil bearing capacity using soil physical parameters, characteristics of vegetation, and climatic data. The first model that integrates hydrology, plant science, and geotechnical engineering in the mining industry. (University of Alberta, 1999; 2010)

Slope Stability / Erosion Control

SLOPE STABILITY OF PROCESSED WATER STORAGE DAM | ROSEMONT, ARIZONA

Project Engineer responsible for performing slope stability analysis of proposed processed water storage dam. Dam design is governed by the requirements of ADEQ as detailed in the Arizona Mining BADCT Guidance Manual. (Tetra Tech, 2011)

EXCAVATION PLAN/SLOPE STABILITY/OBSERVATION, GOULD ELECTRONICS, INC. | CHANDLER, ARIZONA

Project Engineer responsible for the preparation of Excavation Plans for the demolition and remediation of existing industrial plant. Slope stability analyses were conducted for the side slopes of the temporary excavation. The maximum depth of the open excavation was about 33 feet and the maximum side slope recommended was 0.5H:1V, which was based on a minimum factor of safety of 1.5. Observation of the excavation side slopes were performed twice per month giving recommendations to correct deficiencies and making modifications during excavation depending on soil profile changes. (GEC, 2007 to 2008)

Rock Mechanics and Pit Slope Angle Recommendations

PRE-FEASIBILITY LEVEL PIT SLOPE DESIGN, RHYOLITE RIDGE | NEVADA

As Senior Geotechnical Engineer, conducted geological mapping of rock outcrops, performing kinematic analyses using the stereographic projection method, directing overall stability analyses using limit equilibrium method. Final product was a report providing bench configuration, inter-ramp slope angle, and overall slope angle. (Tierra Group, 2018)

DETAIL LEVEL PIT SLOPE ANGLE RECOMMENDATIONS, AGNICO EAGLE | MEXICO

As Project Manager, conducted geotechnical investigation, directed laboratory testing, and performed analysis to provide detail pit slope angle recommendations for the open pit. (Tetra Tech, 2011 to 2012, 2015)

PIT SLOPE ANGLE RECOMMENDATIONS PRE-FEASIBILITY LEVEL, AMERICAN MANGANESE, ARTILLERY PEAK PROJECT | ARIZONA

As Project Manager, conducted geotechnical investigation, directed laboratory testing, and performed analysis to provide preliminary pit slope angle recommendations for the proposed open pit. (Tetra Tech, 2011 to 2012)

PIT SLOPE ANGLE RECOMMENDATIONS PRE-FEASIBILITY LEVEL, WILDCAT SILVER, HERMOSA PROJECT | ARIZONA

Project Manager responsible for conducting geological mapping of rock outcrops. Performed Stereonet projection analysis using DIPS software and limit equilibrium analyses using RocPlane and Swedge to determine the safe pit slope angles. (Tetra Tech, 2011 to 2012)

GEOTECHNICAL INVESTIGATIONS/ROCK SLOPE STABILITY ANALYSIS | CAVE CREEK, ARIZONA

As Project Manager and Lead Geotechnical Engineer, evaluated and improved the stability of a 300-foot long rock slope located adjacent to a 56-unit townhouse complex. The purpose of this stability analysis was to evaluate the stability of the rock slope and the potential for reducing the number of retaining walls in the current development plan. Work included geological mapping, stereonet analysis of strike and dip of rock joints, rock stability analysis, and preparation of report providing recommendations. (GEC, 2007)

PIT SLOPE ANGLE RECOMMENDATIONS UPDATE, BRIGUS GOLD, BLACK FOX MINE | ONTARIO, CANADA

Project Manager acting as qualified person to update the pit angles previously recommended by others. The work included a site visit, data review, and writing a section of the NI43-101 update report. (Tetra Tech, 2012)

Subsurface Investigation

GEOTECHNICAL INVESTIGATION, PARCLAND CROSSING MIXED USE DEVELOPMENT | CHANDLER, ARIZONA

Project Manager responsible for geotechnical investigation of an 80-acre commercial and residential development. Supervised field investigation and oversaw sampling and testing programs. Provided geotechnical recommendations for all aspects of the proposed development, including residential and commercial structures, local, collector, and arterial roadway pavements and utility line installation. Arterial and collector roadways included sections of Alma School Road and Willis Road. Performed evaluation of suitability of the use of buried PVC pipe as specifically required by the City of Chandler. (GEC, 2008)

GEOTECHNICAL INVESTIGATION, DYSART ROAD IMPROVEMENT | EL MIRAGE, ARIZONA

Project Manager responsible for geotechnical investigation for 1-mile of Dysart Road from Peoria Avenue to Northern Avenue. Developed traffic control plan and coordinated traffic control during the field exploration. Supervised field investigation and oversaw sampling and testing programs. Provided geotechnical recommendations for arterial roadway pavements. (GEC, 2008)

GEOTECHNICAL INVESTIGATION, PRASADA COMMERCIAL DEVELOPMENT | SURPRISE, ARIZONA

Project Manager responsible for geotechnical investigation for a 425-acre commercial development. Supervised field investigation and sampling and testing programs. Provided geotechnical recommendations for all aspects of the proposed development, including foundation recommendations, and local, collector, and arterial roadway pavements. Structures included retail shops, office buildings, warehouses, etc. Arterial roadways included sections of Cotton Lane, Greenway Road, Sarival Avenue, Cactus Road, and Waddell Road. (GEC, 2008)

Professional Affiliations

ASCE, Member

Canadian Geotechnical Society, Member

National Council of Examiners for Engineering and Surveying, Volunteer

Publications / Presentations

Silva M, 2016. *Stress Redistribution of Adjacent Solution Collection Pipes* (main-author), Proceedings of Heap Leach Mining Solutions, Lima, Perú, 18-20 October 2016.

Silva M, 2016. *Solution Collection Pipes on Slopes* (main-author), Proceedings of Heap Leach Mining Solutions, Lima, Perú, 18-20 October 2016.

Silva M, 2010. *Review of Oil Sands Tailings Technology Options* (co-author), Proceedings of the 14th International Conference on Tailings and Mine Waste, Vail, Colorado, USA, 17-20 October 2010, pp 381 -392

Silva M, 2010. *Plant dewatering of tailings: experimental results and model predictions*, (main-author), Paper submitted for publication to the Canadian Geotechnical Journal, 2010.

Silva M, 2010. *Prediction of bearing capacity of vegetated composite tailings*, (main-author), Paper submitted for publication to the Canadian Geotechnical Journal, 2010.

- Silva M**, 2006. *Integrated bioengineering treatments for streambank restoration and stabilization along a landfill*, (co-author), Journal of Soil and Water Conservation Issue: 61 (3), 2006.
- Silva M**, 2003. *The Use of Engineered Living Systems to Replicate Natural Site Hydrology and Protect Receiving Waters in Urban Landscapes*, (Presenter), Harvard School of Design, Ecological Engineering for Integrated Water Management Conference 2003: Designing Urban and Industrial Watersheds, Cambridge, MA, 2003. Harvard School of Design.
- Silva M**, 2003. *Alewife Stormwater Wetland: Water Quality Enhancement and Habitat Creation in an Urban Wild*, (Presenter), National Symposium, Wetlands 2003: Landscape Scale Wetland Assessment and Management, Nashua, NH, 2003.
- Silva M**, 2002. *Plant response on mine waste tailings*, (main-author), Proceedings of the 9th International Conference on Tailings and Mine Waste, 27-30 January 2002.
- Silva M**, 2001. *Determining optimal degree of soil compaction for balancing mechanical stability and plant growth capacity*, (co-author), ERDC TN-EMRRP-SR-26, 2001.
- Silva M**, 2000. *Measurement of Infiltration on root permeated soils*, (main-author), 2000.
- Silva M**, 2000. *Shear strength of root permeated soils*, (main-author), Research paper submitted to EPA, 2000.
- Silva M**, 1999. *Plant dewatering and strengthening of mine waste tailings*, (author), Unpublished Ph.D. Thesis, 1999.
- Silva M**, 1999. *Plant dewatering of tailings: laboratory and computer simulation*, (main-author), Proceedings, Tailings and Mine Waste '99 Conference, 24-27 January 1999.
- Silva M**, 1998. *Plant dewatering of tailings: model validation*, (main-author), Proceedings of the 51st Canadian Geotechnical Conference, October 1998.
- Silva M**, 1998. *Plant dewatering of tailings: a theoretical model*, (main-author), Proceedings of the 51st Canadian Geotechnical Conference, October 1998.
- Silva M**, 1998. *Plant selection for dewatering and reclamation of tailings*, (main-author), Proceedings of the 15th annual meeting of the American Society for Surface Mining and Reclamation, May 1998.
- Silva M**, 1997. *Plant dewatering and strengthening of mine waste tailings*, (Presenter), Geotechnical Society of Edmonton, Edmonton, AB, 1997. Geotechnical Society of Edmonton.
- Silva M**, 1997. *The strength enhancement mechanism of plants: preliminary results*, (Presenter), Annual Meeting of the Canadian Society of Civil Engineers, Edmonton, AB, 1997.
- Silva M**, 1997. *Plant dewatering and reclamation of mine waste tailings*, (Presenter), Department of Civil and Environmental Engineering. University of Alberta, 1997. Department of Civil and Environmental Engineering. University of Alberta.
- Silva M**, 1982. *Groundwater Hydrology Handbook and Lecture Notes*, (co-author), National Autonomous University of Nicaragua, 1982.

Employment History

CURRENT EMPLOYER	TIERRA GROUP INTERNATIONAL, LTD.
POSITION	Senior Geotechnical Engineer
YEARS	2015 to Present
EMPLOYER	TETRA TECH, INC.
POSITION	Senior Geotechnical Engineer
YEARS	2010 to 2015
EMPLOYER	BGC ENGINEERING
POSITION	Senior Geotechnical Engineer
YEARS	2009 to 2010

EMPLOYER	GEC
POSITION	Project Manager/Senior Geotechnical Engineer
YEARS	2005 to 2009
EMPLOYER	THE BIOENGINEERING GROUP
POSITION	Branch Coordinator/Senior Geotechnical Engineer
YEARS	1999 to 2005
EMPLOYER	UNIVERSITY OF ALBERTA
POSITION	Research Engineer
YEARS	1995 to 1999
EMPLOYER	SHELBY ENGINEERING
POSITION	Project Engineer
YEARS	1991 to 1995
EMPLOYER	UNIVERSITY OF NICARAGUA
POSITION	Director of Civil Engineering School/Professor
YEARS	1981 to 1988

Language Proficiency

Spanish: Native
English: Fluent
Russian: Familiar (studied Master degree in Russian language in Ukraine)