THURBER

PIPELINE SCOPE OF SERVICES | 2025

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1. Introduction

At Thurber, our purpose is clear: to make a difference for people. Whether it's through geotechnical investigations, environmental remediation, or pavement assessment, our goal is to deliver solutions that enhance lives and strengthen communities.

We are passionate about our work, committed to quality, and deeply care about what we do and the communities we serve. Collaboration is at the core of our approach—we work together with our teams, clients, and stakeholders to achieve meaningful results.

Proudly Canadian and employee-owned since 1957, Thurber is dedicated to building a better future, one project at a time.

1.1 Why Thurber?

We have decades of experience providing engineering, earth sciences, construction, and environmental services across Canada. Our experienced specialists are passionate about delivering practical, high-quality, and effective solutions that meet your project needs.

Our experience includes:

- Pipelines
- Oil and gas facilities
- Mining
- Transportation infrastructure
- Municipal infrastructure and community developments
- Building design
- Power transmission and production
- Marine, industrial, and land development

This brochure outlines our core pipeline services. Please feel free to reach out if you have any questions or need further clarification:

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OUR **PURPOSE**

To make a difference for people

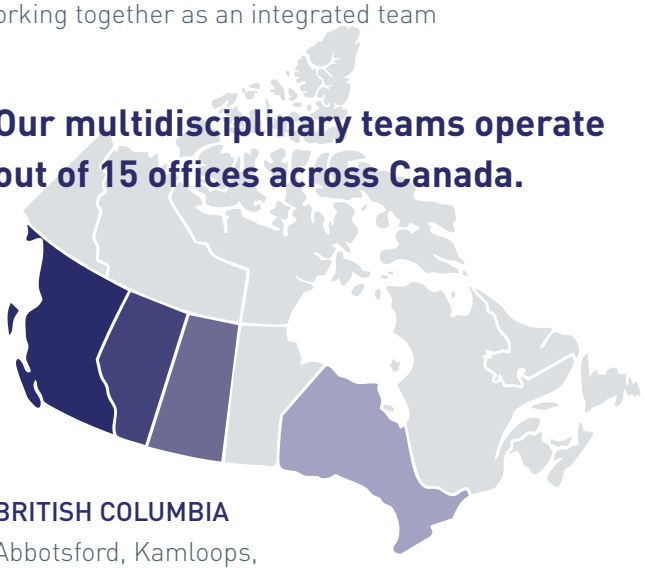
We are committed to making a positive difference for our families, clients, colleagues, and communities. We verify that the infrastructure sustaining our communities is built on strong, reliable foundations; offer our employees rewarding career opportunities; and give back through charitable initiatives, scholarships, and sponsorships. Guided by our purpose, we are committed to fostering employee development, driving sustainable growth, strengthening brand recognition, and upholding employee ownership as we move forward.

OUR **CORE VALUES**

Passion, quality, caring—together

Passion for what we do
Quality in all our activities
Caring about each other, our clients, and our communities
Working together as an integrated team

Our multidisciplinary teams operate out of 15 offices across Canada.



BRITISH COLUMBIA
Abbotsford, Kamloops,
Prince George, Squamish, Vancouver, Victoria

ALBERTA
Calgary, Edmonton, Fort McMurray

SASKATCHEWAN
Saskatoon

ONTARIO
Cambridge, Oakville, Ottawa, Pickering, St. Catharines

2. Geotechnical Engineering and Earth Sciences

If it is built in, on, or with the earth, then Thurber has the professionals for your project. Due to the action of natural processes, subsurface conditions are often complex and highly variable. We offer specialized knowledge and experience in geotechnical engineering and earth sciences to address subsurface challenges, including tunnelling and trenchless technology, geohazard assessment and mitigation, slope stabilization, foundation engineering, retaining wall design, earthquake engineering, embankments on soft soils, oil sands tailings, and many other areas. Below are some of our key areas of expertise relevant to energy infrastructure.

2.1 Pipeline Routing, Design, and Construction Support

Pipelines pass through areas of complex topography and challenging soil conditions. We support pipeline routing, design, and construction by providing specialized services, including:

- Geohazard assessments
- Geotechnical site explorations and characterization
- Field reconnaissance
- Geohazard mitigations
- Facility engineering
- ML/ARD assessments
- Trenchless crossing feasibility assessments
- Aerial crossing design support
- Vibration monitoring
- Permitting support

2.2 Tunnelling and Trenchless Installations

The completion of new pipeline infrastructure in complex urban areas or near environmentally or geologically significant features often requires trenchless techniques, such as horizontal directional drilling (HDD), direct pipe installation (DPI), microtunnelling (MT), and horizontal auger boring (HAB), to minimize the impact on or avoid these features.

Thurber has undertaken geotechnical assessments and supported the design of thousands of trenchless crossings in Canada across a wide range of ground conditions.

Our tunnelling and trenchless professionals focus on appropriately delineating the geological hazards and risks that could threaten the completion of a crossing or the integrity of the infrastructure. We work with challenging ground conditions, such as landslides, artesian groundwater, abandoned coal mines, liquefiable soils, and permafrost. Our relationships with a range of geotechnical drilling and geophysical subcontractors help solve geotechnical and earth challenges in a cost-effective way.

Thurber operates as an independent third-party reviewer on behalf of Canadian Pacific Railway (CPR) for utility crossing requests made by others. We provide guidance on crossing permit requirements established by CPR and Canadian National Rail (CNR).

2.2.1 Circular Shaft Design

We offer our trenchless clients specialized circular shaft design services. We can identify and mitigate potential risks and provide technical and practical solutions for circular shafts used in tunnelling or trenchless applications.

2.3 Geohazards

Geohazard assessment and management encompasses a range of services that help asset owners and operators understand the risks posed by geohazards to infrastructure and develop methods to manage those risks.

Thurber's expertise extends to all geohazards that can occur within a Canadian environment, including landslides in both soil and rock, rockfall, debris flows and floods, surface water (hydrotechnical) hazards, seismic hazards, subsidence hazards (e.g., karst terrain, coal mining), geo-environmental hazards, and anthropogenic hazards.

2.3.1 Screening and Identification

Geohazard screening and identification is an important first step in geohazard management for pipelines. Screening and identification assessments need to combine the right data sources with the right level of experience and familiarity with regional characteristics to accurately identify potential geohazards. If a geohazard inventory is too conservative, the integrity program may become bogged down by low-priority sites. If it is completed without sufficient data or experience, critical sites may be overlooked.

We provide customized support for geohazard inventory development to check that the applied screening criteria align with the project context and needs. Our team is familiar with current regulations and professional guidelines and can confirm that your geohazard inventory meets applicable regulations and aligns with the current professional guidelines and standards of practice.

2.3.2 Assessments and Management

Once geohazards have been identified, the next step is to appropriately assess and prioritize management efforts for your pipeline system to effectively reduce the risk to your assets. This can include high-level, system-wide or regional assessment studies or detailed assessments and management plans for single hazards. Our team applies and interprets standard geohazard assessment and monitoring techniques and provides recommendations to reduce hazard-related uncertainty, ultimately reducing or managing risks to pipeline operations.

2.3.3 Mitigations

Where geohazard mitigation is required, we design both short-term and long-term remedial and stabilization measures.

Our mitigation design services include:

- Slope stabilization engineering
- Erosion and surface water drainage controls
- Rock fall protection barriers
- Debris flow mitigations
- Rock bolting and rock slope stabilization
- Strain reliefs
- Pipeline replacement and reroutes
- Aerial crossing design support
- Surface pipeline design

2.3.4 Climate Change Assessments

We assess the influence of climate change on future geohazard occurrences based on climate change model outputs. We can provide guidance on effectively incorporating climate change predictions into geohazard assessments, management programs, or mitigation design.

Our experience with climate change assessment includes both regional and site-specific assessments. We also support stakeholder engagement to develop the assessment criteria and identify the most relevant outputs.

2.4 Terrain Analysis and Terrain Mapping

Terrain analysis is the process of identifying geological landforms and assessing their properties based on an understanding of their formational history. Terrain mapping is the process of mapping surficial deposits and related landforms while also providing information on current geomorphological processes. Both terrain analysis and mapping are leveraged for pipeline routing and design, as well as hazard interpretation and trenchless crossing feasibility and design.

Our terrain mapping professionals provide guidance on how to best leverage this expertise for your pipeline or linear infrastructure project.

2.5 Site Explorations and Characterizations

Geotechnical engineering differs from other engineering disciplines in that it involves highly variable and complex materials. Unlike concrete or steel, whose properties are understood and vary minimally, soil and bedrock can vary dramatically over just a few metres. The degree of geotechnical complexity for a pipeline project depends on the geological depositional history of the soils / bedrock, topography, and physical setting (urban, rural, mountainous).

The goal of any site characterization program is to inform the design and reduce uncertainty to a reasonably practicable level, while balancing schedule and cost considerations. This balance is largely established by the design team's technical needs, their professional obligations, the asset being constructed, and the client's risk management strategy for the asset.

Components of a site characterization program may include:

- Desk study: terrain mapping, geology, topographic surveys, geomorphology
- Site explorations: drilling and soil characterization

Generally, the most complex activity to plan and execute is a field drilling program. Since our inception in 1957, we have executed thousands of field drilling programs and drilled tens of thousands of boreholes across Canada.

2.6 Remote Sensing

We can incorporate remote sensing techniques into geohazard assessment and management programs. We help select the right tool for the application and scope the data collection and analysis methods. We partner with vendors who can support with data acquisition. Once the data has been acquired, we can provide site-specific interpretations and recommendations, and we work with our clients to develop practical management or mitigation solutions as required.

Thurber can support program design, including the collection and interpretation of:

- LiDAR and differential LiDAR
- Airphotos and photogrammetry (including in-house drone options)
- ILI and IMU interpretation
- GPS monitoring and telemetry
- InSAR

2.7 Instrumentation

Maintaining stability and limiting displacement to acceptable levels is an important part of geotechnical design. Geotechnical instrumentation to monitor foundation performance, such as pore pressures, deformations, anchor and strut loads, and tilt and vibrations at sensitive structures, is often required to achieve the desired level of safety and efficiency during construction.

Select services include installation, monitoring, and data interpretation for the following instruments:

- Inclinometers (manual reading and in-place devices)
- Tiltmeters
- Vibrating wire piezometers and settlement cells
- Load and pressure cells
- Real-time or datalogged acquisition systems
- Web-based remote monitoring systems

2.8 Slope Stability Engineering and Retaining Structures

Slope stability engineering involves assessing the static and dynamic stability of natural and man-made slopes in soil and rock, as well as developing mitigation measures. It requires multidisciplinary knowledge of geology, geomorphology, soil and rock behaviour, and analytical methods, including limit equilibrium and numerical methods.

Our expertise includes stabilizing both temporary and permanent cut and fill slopes, stabilizing shallow and deep-seated landslides, and mitigating seismic-related phenomena, such as earthquake-induced slope movements and liquefaction. This experience can be leveraged to support:

- Geohazard mitigations
- Temporary and permanent slope stabilization during construction
- Design of slope retention structures
- Shoring design
- Deep excavations

2.9 Foundation Engineering

Foundation engineering involves the assessment of subsurface conditions for the placement of footings or pile foundations that transfer loads to the ground with limited settlement. When soil or rock lacks adequate capacity to support a structure under static or dynamic loads, ground improvement techniques such as soil densification, grouting, or reinforcement through anchorages or geosynthetics are necessary.

Practicing in this field requires multidisciplinary knowledge of local geology, soil and rock mechanics, and the ability to use analytical and numerical methods. Limit States Design is used to account for load and resistance uncertainties, requiring a knowledge of probabilistic methods.

Expertise:

- Foundation design (e.g., piles, spread footing, rafts)
- LRFD and WSD
- Bearing capacity and settlement analysis
- Lateral earth pressures
- Construction inspection

2.10 Earthquake (Seismic) Engineering

Earthquakes can cause significant structural damage to pipelines. Our engineers provide full soil-structure analysis to understand the seismic history of a site, along with the soil's stability and liquefaction potential. By modelling the soils and understanding their strength, we design ground densification solutions that enhance the soils' ability to withstand vibrations and limit liquefaction, minimizing damage to the built structure during a seismic event. We work in earthquake-prone regions to help design, build, and maintain resilient infrastructure.

Expertise:

- Liquefaction assessment
- Site response analysis
- Soil structure interaction
- Seismic deformation analysis using Plaxis

2.11 Metal Leaching and Acid Rock Drainage (ML/ARD)

Metal Leaching and Acid Rock Drainage (ML/ARD) are naturally occurring processes that can be greatly enhanced by bedrock disturbance. ML is the dissolution of solid material (i.e., metals) into water from minerals in rock at any pH. ARD is caused by the oxidation (i.e., rusting) of sulfide minerals (e.g., pyrite and others) in bedrock, which generates sulfuric acid at rates and in quantities that cannot be neutralized by the inherent neutralization potential (NP) in the rock. Our team can delineate ML/ARD potential for linear infrastructure projects, such as pipelines, as well as develop and execute mitigation and management plans.

3. Hydrotechnical Engineering

Flowing water has the power to erode riverbanks, reduce depth of cover, substantially shift the flow path of watercourses, and expose pipelines to a greater risk of damage or loss of containment. The risk is mitigated through hydrotechnical design and mitigation measures. Thurber's hydrotechnical engineering and fluvial geomorphology specialists understand the challenges associated with pipeline watercourse crossings and can design solutions tailored to reducing risks and environmental impacts at pipeline crossings.

3.1 Watercourse Characterization

Our specialists assess hydrologic characteristics of watercourse crossings to determine the risk of water related hazards, including flooding, scour and degradation, bank erosion, channel avulsion, and debris flows.

The goal of hydrotechnical assessments is to design practical and cost-effective mitigation measures to reduce hydrotechnical risk at pipeline crossings.

Watercourse characterization includes the following steps:

- Desk study, including analysis of historical aerial photographs, hydrometric and meteorologic data, LiDAR and channel bathymetry, and basin characteristics
- Site visits and visual assessment of stream characteristics, including natural channel armouring, channel slope, bed material, and vegetation
- Flood frequency analysis
- one-dimensional and two-dimensional hydraulic modelling of anticipated flooding and geomorphic behaviour

Thurber staff are skilled at using watercourse characterization studies to develop mitigation strategies to mitigate hydrotechnical risk.

3.2 Hydraulic Modelling

The Thurber hydrotechnical team uses inputs from watercourse characterization studies to develop one-dimensional or two-dimensional hydraulic models, which provide insight into anticipated flow rates and physical shear stresses on stream beds near pipeline crossings. Our engineers use the modelling outputs to design mitigation recommendations and structures for pipeline watercourse crossings.

3.3 Watercourse Crossing Design and Mitigations

Whether it is designing a new pipeline watercourse crossing, recommending monitoring strategies for an existing crossing, or mitigating a problem site, our team provides the services needed to minimize risk at pipeline crossing sites. Senior Thurber staff have experience in designing hydrotechnical hazard mitigations at watercourse crossings including:

- Trenchless crossings
- Rip-rap revetment design
- Bed protection structures
- Bridge piers and abutments
- Groynes, vanes, or spurs
- Bio-engineered erosion protection structures, including large woody debris

4. Geographic Information Systems (GIS)

Thurber's Geographic Information Systems (GIS) and design professionals are trained in GIS and CAD software and methods. Our team supports a wide range of infrastructure and development projects through data collection, management, analysis, and visualization.

4.1 Mobile Mapping and Data Collection

We use mobile mapping technology to increase the efficiency of our fieldwork. Our field staff use site-specific, tablet-based maps to access the most up-to-date project information and digitally collect spatial data. This technology works outside of cell service for remote data collection.

When necessary, our mobile system can be used with high-precision GPS receivers, allowing our field staff to capture spatial information with decimeter-level accuracy.

4.2 Spatial Analysis

Our GIS specialists provide a variety of geospatial processing and analysis services:

- Remote data collection support
- Classification, projection, and analysis of spatial datasets
- Change detection
- Georeferencing non-spatial data
- Map and figure production

Our GIS team also maintains an internal database and live mapping interface, which our staff can use to reference a selection of curated public data (e.g., surficial geology maps, drift thickness mapping, water well records) and internal reference data from completed Thurber projects. Additionally, our cloud-based mapping and database integration solutions can be leveraged for individual projects, provided they comply with client data security requirements.

4.3 Mapping and Visualization

Our high-quality mapping products to support regulatory applications, public consultation, and report preparation. We also regularly produce 3D models, renderings, and cross sections or profiles. In addition to digital and printed map products, Thurber can provide web-mapping solutions to share and communicate project information. Web maps can be shared publicly or with specific collaborators to improve the efficiency and clarity of communication across the project team.

5. Construction Services

Our scalable project construction management solutions are tailored to the specific needs of the project, internal client capabilities, or the expertise of other providers engaged by the client. Typically, these services focus on a subset of the overall project, such as managing trenchless construction.

5.1 Constructability Assessment

Our constructability reviews identify foreseeable risks and issues, including routing, trenchless crossing alignment, and feasibility. By combining site exploration (e.g., geotechnical drilling) documents with design inputs, our construction specialists assess and provide feedback on the design. This phase also includes risk ratings, along with contingency and mitigation planning.

5.2 Construction Supervision and Management

Our team can develop a project-specific construction management plan focused on coordinating and overseeing on-site activities, including managing field resources such as safety, environment, engineering, quality, controls, administration, and field services. We can also manage a detailed project budget and implement controls to monitor and report on budget versus actual results.

5.3 Construction Field Engineering Administration

Our team can establish and manage field-level change and information management processes, including Requests for Information, submittals, and transmittals. We oversee all physical and digitally produced documentation on site, ensuring that the latest revisions are accurately distributed and outdated versions are destroyed. We also collect and distribute all daily reports and documents.

5.4 Safety Management and Auditing

Our project safety plans include onboarding, training, safe work procedures, and an audit schedule. Each plan outlines the roles of the Prime Contractor and subcontractors in creating a safe culture on site. We maintain and audit safety records for various stakeholders, while investigating and reporting serious near-miss events, injuries, and property loss.

5.5 Quality Management and Auditing

We develop quality management and inspection plans to check regulatory compliance and meet the owner's engineering requirements. Components of these plans include the Inspection Audit Schedule, Inspection and Test Plan (ITP), Non-Conformances Reporting (NCRs), and records management. We track material properties throughout construction activities, ensuring compliance with the engineer of record and client standards. Our focus is on continuous improvement, including corrective actions and accountability for all resources assigned to the project.

5.6 Project Controls and Contracts

We provide detailed planning for scope assignment, communication, workflows, scheduling, and contract procurement, all of which are critical components of project excellence. We track key performance indicators (KPIs) related to quality, safety, costs, and schedule, which report on the overall health of the project. Additionally, we offer project cost estimating and construction scheduling for applicable service providers contracted to the project.

5.7 Environmental and Indigenous Monitoring

Environmental and Indigenous monitoring requires a dedicated, highly skilled team to coordinate onsite third-party environmental and Indigenous monitors. If needed, we can plan directed learning and knowledge transfer for Indigenous monitors. We also liaise with Indigenous Elders regarding the project, using their expertise in environmental field surveying, right-of-way surveying, and construction monitoring services.

5.8 Construction Monitoring and Testing

We offer a wide range of services to assess the conformance of construction procedures and materials with project specifications, design assumptions, and established construction practices. The longevity of construction and construction materials is of paramount economic importance in all projects.

Select services include:

- Pile construction monitoring and load testing
- Vibration monitoring for active construction near critical infrastructure
- Soil proof rolling
- Earthwork construction monitoring and compaction control
- Concrete placement monitoring and testing
- Asphalt placement monitoring and testing
- Precast concrete production monitoring
- Road construction monitoring
- Pipeline construction monitoring

We provide materials engineering consulting to select and design construction materials that meet the specified service life of structural components. Additionally, we offer in-place condition evaluation services to assist in designing repair or remediation measures required to extend the service life of structural components.

5.9 Laboratory Testing

A laboratory testing program is an integral part of geotechnical site characterization and supports construction monitoring activities, such as compaction control. While routine projects typically involve index tests like the determination of Atterberg Limits or Grain Size Distribution, the design of major structures, such as dams, high-rise buildings, open-pit mines, and tunnels, requires advanced testing to assess consolidation, permeability, and strength properties.

Thurber's advanced soil testing services include:

- Triaxial testing
- Direct Shear and Direct Simple Shear
- Permeability
- Consolidation

6. Environmental Services

Our environmental professionals are skilled in all phases of Environmental Site Assessment (ESA) and remediation. We approach each project from multiple viewpoints, including regulatory requirements, financial risk and liability, and practical solutions.

From simple Phase 1 ESAs to complex contamination assessment and remediation programs, our team has the depth and experience to minimize client risk and maximize the value of an asset. Below are some specific areas of experience relevant to the pipeline sector.

6.1 Drilling Waste (Mud) Management and Disposal

We develop and execute drilling waste (mud) management plans for Alberta, British Columbia, and Saskatchewan. Our team will conduct an initial site review to determine available water sources for the HDD and determine the best options for temporary storage and final disposal. During HDD operations, we monitor and test the materials to direct disposal activities, and complete the necessary regulatory reporting. We can also provide construction management for the disposal activities.

6.2 Drilling Waste Containment Structures

The oil and gas sector requires containment structures to manage industrial fluids and waste as part of normal operations. We have extensive experience in the siting, design, and construction monitoring of below-grade and above-grade earth structures used for landfilling drilling wastes or containing other fluids, such as brines. We design both clay-lined and geosynthetic-lined facilities. Additionally, we are familiar with the Canadian Dam Safety guidelines and their application to these structures.

6.3 Spill Site Phase II and III ESA Monitoring

Our environmental team conducts Phase II and III ESAs and spill site monitoring programs for the oil and gas sector. We work with many oil and gas operators to delineate soil and groundwater contamination in accordance with provincial guidelines, such as the Alberta Environment and Protected Areas (EPA) Tier 1 Soil and Groundwater Remediation Guidelines, at pipeline and facility spill sites.

We monitor potential contaminate migration, present and implement remedial measures (such as Bio Reclaim to reduce PHC concentrations), and prepare regulatory reports.

6.4 Remediation

Remediation involves containment, removal, or stabilization of contaminants from soil, groundwater, or vapour. If a site is contaminated, remediation is normally required to prevent further environmental impact. Thurber establishes remediation goals based on regulatory requirements and the environmental risk assessment. We then develop a remediation strategy and oversee the execution and monitoring of the remediation to verify that it complies with protocols and remediation objectives.

6.5 Decommissioning and Land Reclamation Planning

When a site has been used for industrial or infrastructure purposes and has reached the end of its operational life, it must be decommissioned. Thurber helps plan decommissioning activities to ensure the site is safely taken out of service while minimizing risks to human health, safety, and the environment.

6.6 Hydrogeology

A hydrogeological investigation is a comprehensive scientific study that focuses on assessing the distribution, movement, and properties of groundwater within a particular geological setting.

This process helps determine the sustainable yield of groundwater resources, identify potential sources of contamination, and assess the feasibility of groundwater extraction projects. It supports informed decisions regarding water resource management and environmental protection.

6.7 Compliance Monitoring

The legacy of the past production and mishandling of solid and liquid wastes is a major public concern in many communities across Canada. Stricter and wider-reaching environmental regulations, as well as broader applications of common law, can impose responsibilities and liabilities on government, businesses, and industries who have inherited contaminated sites that present a risk to human health and the environment.

Regardless of whether these sites have been remediated, independent monitoring and reporting are often required. Thurber has expertise in designing, implementing, and reporting on compliance monitoring programs in accordance with local regulatory frameworks and for due diligence purposes.

6.8 Waste Disposal

Planning and designing modern waste disposal facilities requires extensive knowledge of geotechnical engineering and hydrogeology. Additionally, construction quality control of all engineered barriers for these facilities requires reliable testing techniques, and long-term monitoring and reporting are typically required to ensure compliance with regulatory guidelines. Thurber has contributed to all phases of projects for disposal facilities receiving solids, sludges, and liquid wastes, including MSW and oilfield landfills, as well as tailings dams and waste rock dumps in the mining industry.

Select expertise includes:

- Geotechnical and hydrogeological investigations
- Laboratory permeability testing
- Air Entry Permeameter (AEP) testing of clay liners
- Construction supervision and quality control
- Long-term instrumentation and monitoring

7. Safety and Prime Contractor

We are strongly committed to the personal safety and health of our employees and subcontractors. We have a comprehensive safety program that is supported by all levels of management. Preventing occupationally induced injuries and illnesses is of equal or greater importance than quality, productivity, and cost control. Our safety objective is to complete each project with zero injuries and incidents. Thurber is COR certified and has been a member of ISNetworld since 2006. Our ISN ID Number is 400-134547.

Recognizing the challenges our clients face with safety management, we have taken on the role of Prime Contractor and established ourselves as trailblazers in this field. We fully understand the heightened responsibility that comes with managing as a Prime Contractor, including the numerous safety requirements set forth by legislation, the logistics and planning of the project, and the risks and liabilities associated with this role.

We have extensive experience managing geotechnical programs as a Prime Contractor on a variety of projects, ranging in size and complexity, for clients such as the City of Calgary, TransCanada Pipelines, ATCO Pipelines, and others.

Critical elements to our Prime Contractor management program include:

- Training
- Comprehensive yet simple-to-follow HSE plans
- A comprehensive Contractor Safety Management System
- Surveillance and monitoring of work sites

8. Recent Projects

Since 1957, Thurber has completed over 53,000 projects, the majority of which have been in Western Canada. A selection of our recent, relevant projects is outlined in the following section.

8.1 ATCO Southwest Calgary Connector

ATCO's Urban Pipeline Replacement (UPR) Project replaced and relocated high-pressure natural gas pipelines in Calgary and Edmonton.

Thurber undertook geotechnical trenchless feasibility and geohazard assessments within the Transportation Utility Corridors within Calgary and Edmonton for the following large diameter pipeline projects:

Calgary

- Northeast Calgary Connector (NECC)
- East Calgary Connector (ECC)
- Southeast Calgary Connector (SECC)
- Southwest Calgary Connector (SWCC)
- Northwest Calgary Connector (NWCC)

Edmonton

- Northwest Edmonton Connector (NWEC)
- Southwest Edmonton Connector (SWEC)
- South Edmonton Connector (SEC)

The Southwest Calgary Connector involved the construction of a 14-km-long NPS 20 natural gas pipeline in Calgary. Completed in late 2017, the Elbow River crossing is ATCO's longest Drill Intercept HDD crossing at 1,760 m. Thurber conducted screening and scoping studies for the proposed alignment, followed by a detailed geotechnical investigation at several major trenchless crossings. The initial study involved conducting a terrain and geohazard assessment based on a review of airphotos, bare earth LiDAR, and both published and unpublished geotechnical and geological information.

8.2 Trans Mountain Expansion Project (TMEP)

The Trans Mountain Expansion Project (TMEP) twinned the existing 1,181 km pipeline from Edmonton, AB to Burnaby, BC, increasing its capacity from 300,000 to 890,000 barrels per day.

Thurber provided geotechnical support to the General Construction Contractor on spreads 5A and 5B, including the following:

- Metal leaching/acid rock drainage (ML/ARD) plan development for TMEP
- Preconstruction grade plan assessment
- Geohazard assessment and mitigation design
- Multipurpose geotechnical investigations
- Steep slope grade reinstatement recommendations
- Geotechnical monitoring services during construction
- Vibration monitoring
- ML/ARD monitoring and rapid testing services
- Weather station development, monitoring, and reporting
- Development of wet weather shutdown criteria and reporting
- Major and minor trenchless crossing investigations and recommendations
- Tunnel assessment and design
- Retaining wall design
- Desktop and field fit trench breaker locations
- Rockfall assessment, design, and mitigation
- Steep slope grade reinstatement recommendations

8.3 Eagle Mountain Woodfibre Gas Pipeline (FortisBC c/o UPI) - IN PROGRESS

Since 2019, Thurber has supported engineering efforts for a 40-km-long NPS 24 natural gas pipeline between Coquitlam and Squamish, BC.

Thurber's scope of work has included:

- Detailed terrain mapping of the pipeline corridor
- Geohazard identification, assessment, and mitigations
- Multiple site investigation programs, including drilling and geophysics
- Multiple field reconnaissance programs
- Slope stability assessments
- Trenchless crossing assessments
- ML/ARD assessments and development of a management plan to support construction
- Grade plan reviews
- Development of typical designs to support construction

Thurber's geohazard assessment work has been used to inform the pipeline design and to identify appropriate risk management actions for the assessed geohazards. Thurber will continue as the EOR through construction.

Fortis has recently started construction of this pipeline and Thurber is providing ongoing engineering support to Fortis.

8.4 Coastal GasLink Pipeline

The Coastal GasLink pipeline traverses mountainous terrain with remote access challenges. Once operational, it will bring LNG from Alberta to the BC coast.

Thurber was retained to conduct the following:

Terrain and Hazard Assessment
Conducted a geohazard assessment for multiple spreads, prepared mitigation measures, and provided geotechnical recommendations for unstable terrain along the pipeline route.

Excavation Support
Provided geotechnical services for the design of piles for the Stuart River Bridge (the largest temporary bridge in North America at the time) and sheet pile design for the pipeline trench at 35 sites over 250 km.

Geotechnical Engineering and Field Investigative Services for Compressor Stations
Conducted supplemental geotechnical investigations on six compressor stations and a full geotechnical program on a seventh site along the pipeline alignment.

Thurber Engineering Ltd.
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