GeoExchange BC

User Guide

Supplemental guide to the

Professional Guidelines

for Geoexchange Systems
in British Columbia

Disclaimer

User Guide

Supplemental to the set of four Professional Guidelines for Geoexchange Systems in British Columbia

First Edition

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GeoExchange BC

Acknowledgements

USER GUIDE

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GeoExchange BC – in pursuit of performance

Dear Reader,

GeoExchange BC is a not for profit provincial industry association in British Columbia dedicated to the education, promotion and responsible design and installation of low temperature ground source (geoexchange) energy systems. Our mission and vision is to promote information sharing between industry professionals and other stakeholders associated with the geoexchange industry, as well as to maximize the energy performance of geoexchange systems to realize their full financial, environmental, and social benefits.

Geoexchange BC has published this document as one of a series of guidelines to educate key players on the requirements of a successful geoexchange project. These guidelines also help establish a strong standard of practice for the industry going forward. Each guideline covers a separate topic and is focused on commercial-scale applications within BC, although many of the concepts are applicable to smaller projects and other regions. The guidelines are for use by developers, owners, coordinating professionals, construction managers, engineers, installers and commissioning teams. The primary goal of these guidelines is to assist a project team in delivering a cost-effective geo-exchange system that will provide reliable operation and energy savings throughout the life of the system.

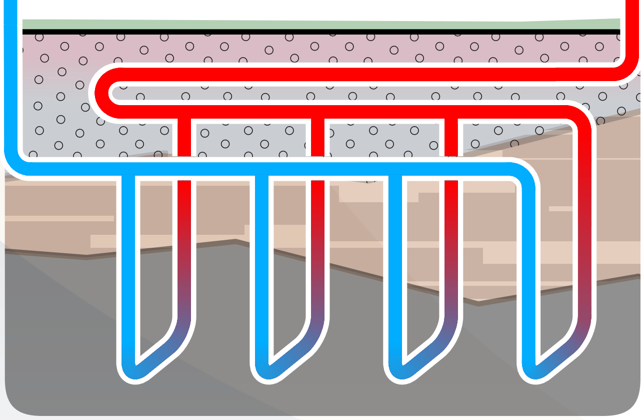
A supplemental User Guide has also been developed to facilitate access to all the detailed information contained within the guideline documents. The User Guide summarises the key content of each guideline, provides a flowchart and checklist format for guidance and record-keeping, and identifies topics within the guideline relevant to each key player on the project team.

We hope and expect that these guidelines will be of great service to you, to your industry peers, and consequently to all British Columbians alike.

Best regards,

David Cookson, B.Eng MBA
Project Director, GeoExchange BC

GeoExchange BC



What is Geoexchange?

Geoexchange systems utilize a readily available source of renewable energy to heat and cool a building. This energy is essentially solar radiation stored within the upper crust of the earth, and it can be tapped wherever you have access to the earth, ground water, a lake, or the ocean.

Geoexchange and heat pump technology is long established with the first systems developed and implemented in the 1950's. With increasing awareness, improved equipment and industry expertise, and the high cost of energy in recent years, the technology has experienced a resurgence.

A geoexchange system includes three primary components – a ground heat exchanger (GHX), a heat pump, and a building distribution system. The GHX is the focus of these guidelines. A typical commercial-scale GHX installation involves drilling vertical boreholes to a depth that ranges from 50 m to 150 m, depending on ground conditions. Long lasting High Density Polyethylene (HDPE) piping is inserted into these boreholes, which are then sealed with a clay-based grout to provide protection to sub-surface groundwater and ensure good heat transfer with the earth.

Once these pipes are connected together in closed-loop header arrangements, a freeze-protected solution is pumped throughout the piping network. By using a heat pump, the fluid can either extract energy from the earth for use in building heating or reject excess heat from the building to the earth in order to provide building cooling.

Where site conditions and construction costs warrant, there are alternatives to the vertical drilled GHX; primarily horizontal or surface-water closed-loop exchange, or groundwater "open-loop" exchange.

Although some electricity is required to drive the heat pump and circulation pumps, well-designed geoexchange systems can deliver 75% of the total heating energy from renewable energy stored in the ground. Most of the energy is harvested from the earth rather than by combustion of fossil fuels or resistance of electricity.

Geoexchange systems are a proven and reliable solution to boost energy efficiency and reduce carbon emissions, and have attracted significant attention. Although it appears deceptively simple, geoexchange technology relies on the integration of mechanical components to adapt to complex site-specific earth and building thermodynamic processes.

Who We Are

Geoexchange BC is a not for profit organisation dedicated to the education, promotion and responsible design and installation of geoexchange systems.

The Need For BC Guidelines

Recognising the reported gap between expectations and performance for some geoexchange projects, Geoexchange BC has published a series of guidelines to educate key players on the requirements of a successful geoexchange project. These guidelines also help establish a strong standard of practice for the industry going forward. Each guideline covers a separate topic and is focused on commercial-scale applications within BC, although many of the concepts are applicable to smaller projects and other regions.

There are four guidelines in the current series:

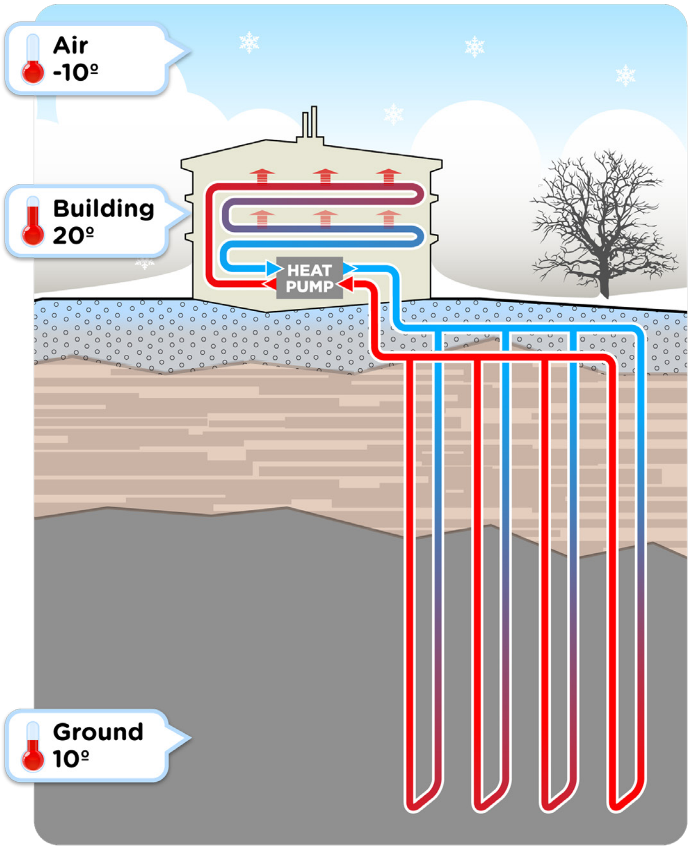
Part 1: Assessing Site Suitability and
Ground Coupling Options
Part 2: Design
Part 3: Commissioning
Part 4: Procurement

The guidelines are for use by developers, owners, coordinating professionals, construction managers, engineers, installers and commissioning teams.

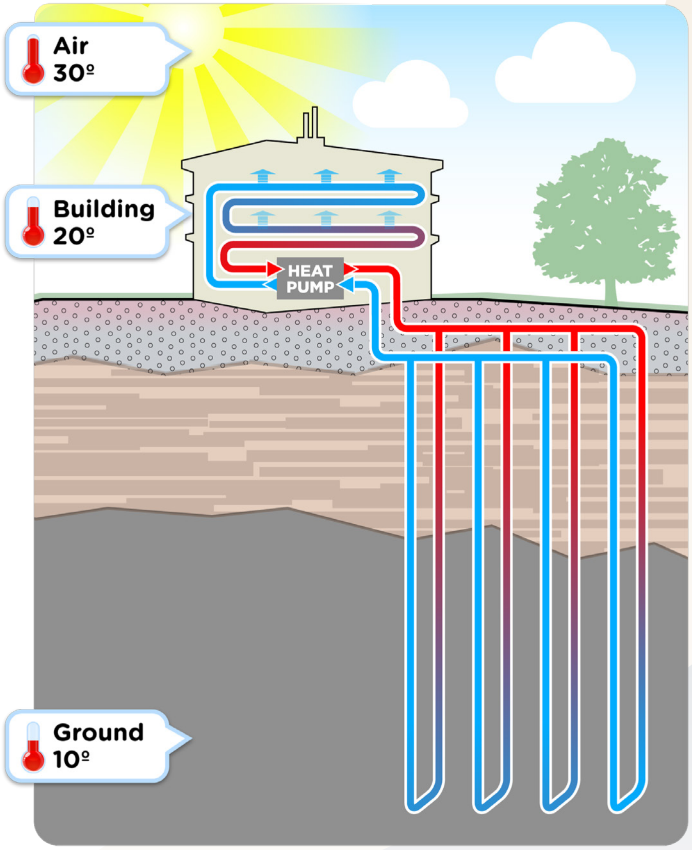
The primary goal of these guidelines is to assist a project team in delivering a cost-effective geoexchange system that will provide reliable operation and energy savings throughout the life of the system.

Long-term system viability and performance requires a rigorous and thorough design approach

Geoexchange as a heating solution



Geoexchange as a cooling solution



Horizontal closed loop ground heat exchanger

Closed loop surface water heat exchanger

based on science and judgement, quality construction by experienced trades, and a complete and detailed system commissioning.

Failure to adequately design, install, commission, and control a geoexchange system will result in significantly reduced performance and undo the business case for making the investment in geoexchange.

Those working on a geoexchange project for the first time may be unaware of the complexities of geoexchange design and construction. British Columbia's extremely variable geography, climate, and building demographics require that each project design is unique and site-specific. Thorough and expert information tailored to BC is needed to ensure that systems meet the needs and expectations of owners and proponents in terms of specific environmental, social, and financial benefit targets.

This User Guide has been developed to facilitate access to all the detailed information contained within the guideline documents. It summarises the key content of each guideline, provides a flowchart and checklist format for guidance and record-keeping, and identifies topics within the guideline relevant to each key player on the project team.

Studies and feedback have demonstrated that where a thorough and thoughtful process is taken towards GHX selection, design, construction, commissioning, and operation, such projects deliver energy and cost savings that meet, and often exceed, original expectations. It is the hope of Geoexchange BC that by sharing the knowledge assembled within these guidelines and setting a standard for best practice, all future projects can be similarly successful.

How to Use this User Guide

Contained within this user guide are a series of checklists designed to be used by the Coordinating Professional (CP) to assign responsibilities to team members and record information relevant to the geo-exchange system.

The Geoexchange Project Information sheet allows the CP to record general details and the key players on the project.

The flow chart in Figure 1 outlines the pathway, steps, and decision points in the project implementation. This figure shows how the four parts of the guidelines integrate into the overall process.

A descriptive summary of each guideline is provided. For each part, a task assignment checklist and a documentation record summary sheet are included. These can be used by the CP to assign responsibilities to team members, and by team members to identify topics of relevance to their work. All parties can then research topics in more detail in the full version of the guideline, as required.

The CP can use the summary sheet to record the parties involved and key documents generated for each phase (proposals, quotes, contracts, reports, submittals, etc.). The checklists and forms are also provided as form-enabled PDF files, available separately from Geoexchange BC.

Vertical closed loop ground heat exchanger

Large diameter pipe fusing

Key General Concepts for Successful Geoexchange Implementation

The four guidelines in this series cover the various stages of project implementation in detail, however some key general concepts for a successful project are worth highlighting:

- **Get the integrated team together early.** The owner / Coordinating Professional (CP), engineer, and contractor should meet early and regularly to ensure everyone understands and shares the same goals and objectives. An integrated design process and whole project strategy should cover all aspects from site assessment to commissioning and ongoing performance monitoring.
- **Engage specialist engineers and contractors with proven and successful performance in the geoexchange industry.** Ask for operational system client referrals and qualifications that demonstrate current and recognized training and accreditations such as the CGC* Commercial Designer and Installer or IGSHPA** equivalents.
- **Geoexchange is site-specific.** What is appropriate for a residential building in Vancouver will not likely be the same for a hospital in Prince George. Complete the site assessment and on-site testing early, and ensure resources and service providers experienced with the application and setting are available.
- **Ensure energy loads are accurate, not over-inflated, and that equipment efficiencies are realistic.** The building energy modeller should be coordinating closely with the GHX designer. This will allow them to more accurately target and re-evaluate the energy savings as the project evolves through the design and construction stages. Equipment performance estimates should be based on seasonal modelling analysis and equipment specification data. Be wary about pushing the design team for short term capital cost reductions without thoroughly evaluating the lifetime impact on system performance.
- **Have a clear understanding about what success means for this project and lay out clear goals for the team to achieve it.**

* Canadian Geoexchange Coalition
** International Ground Source Heat Pump Association

Grout mixing

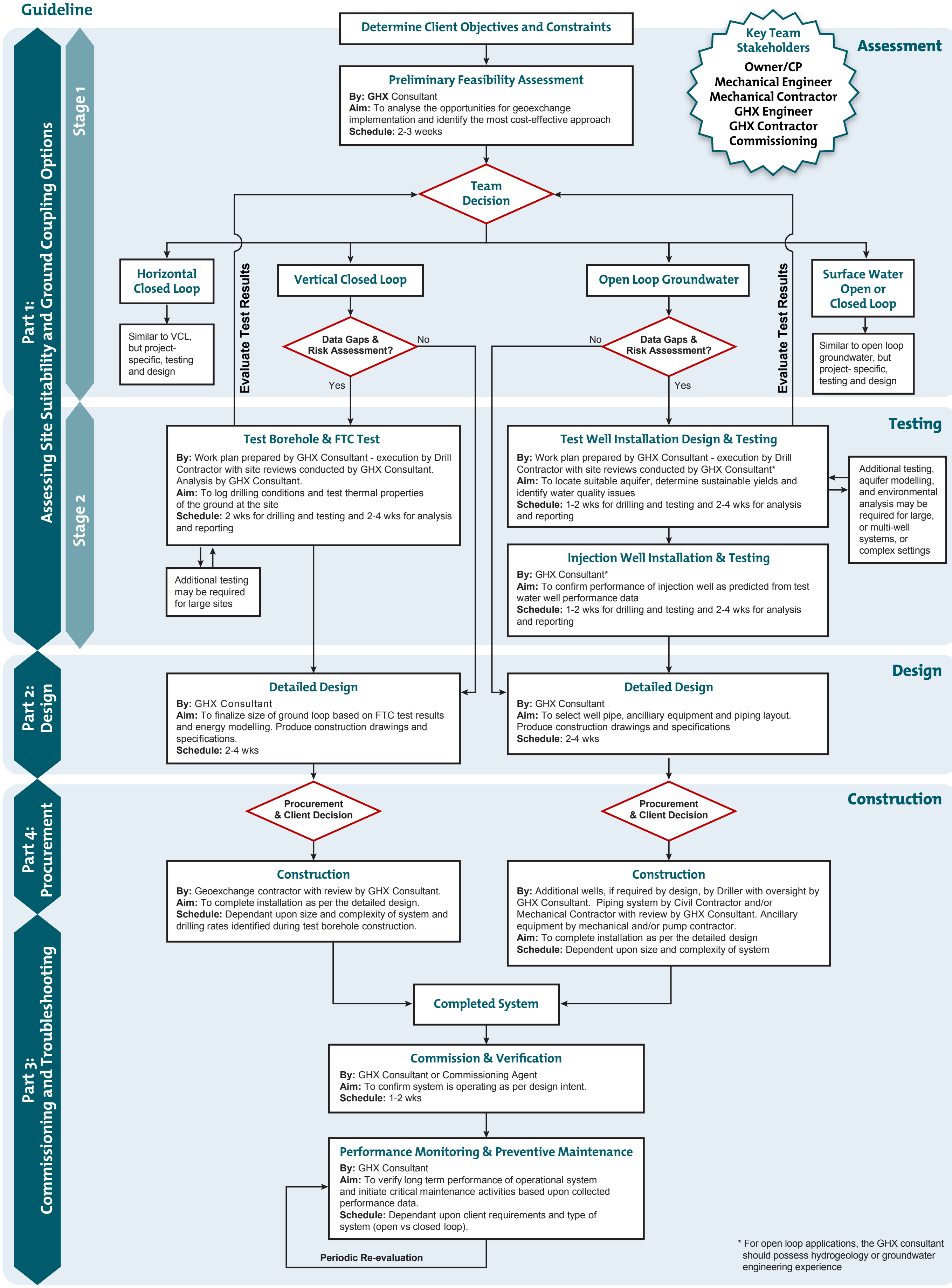
Mud rotary drill rig

Geoexchange Project Information

Is this the as-built record? ☐ **Yes** ☐ **No**		**Building Owner (if different):**	
Project Name:		**Site Address**	
System Owner		**Address**	**Phone**
Building Owner		**Address**	**Phone**
Project Coordinator / Manager		**Address**	**Phone**
Form Completed by:	**Title**	**Date:**	**Overall Project Role**

Project Details:			
Geoexchange ground coupling type:			
New Construction?			
Retrofit?			
Building Architect:			
Building Mechanical Engineer:			
Construction Manager			
Geoexchange Construction Format Design-spec-tender/Design-Build			
Engineer of Record			
Prime Contractor:			
Project Duration (assessment to commissioning)			
Notes:			

Figure 1: A Roadmap for Successful Geoexchange Implementation



* For open loop applications, the GHX consultant should possess hydrogeology or groundwater engineering experience

Part 1 – Assessing Site Suitability and Ground Coupling Options

GOALS

To provide owners and design teams with a methodology for evaluating site-specific suitability for geoexchange, and selecting the most appropriate type of ground heat exchanger (GHX) / option to take forward into the design stage. The GHX types include vertical closed-loop, horizontal closed-loop, groundwater open-loop, surface water open- or closed-loop.

BC has one of the most varied geologies in North America, making a thorough study of site conditions and a comprehensive GHX selection process imperative.

KEY BENEFITS

Applying the steps in this guideline and investing a modest amount of time and effort in the site assessment process will remove many areas of uncertainty relating to system type and site specific ground conditions. This will provide a higher level of certainty in system sizing, energy performance and capital costs to facilitate the go or no-go decision and provide a sound basis for the detailed design. There is an inverse relationship between effort invested in this research at the site suitability stage and risk and expenditure during the design and construction stage. See Figure 2 below for a graphical explanation of this relationship.

SUMMARY OF CONTENTS

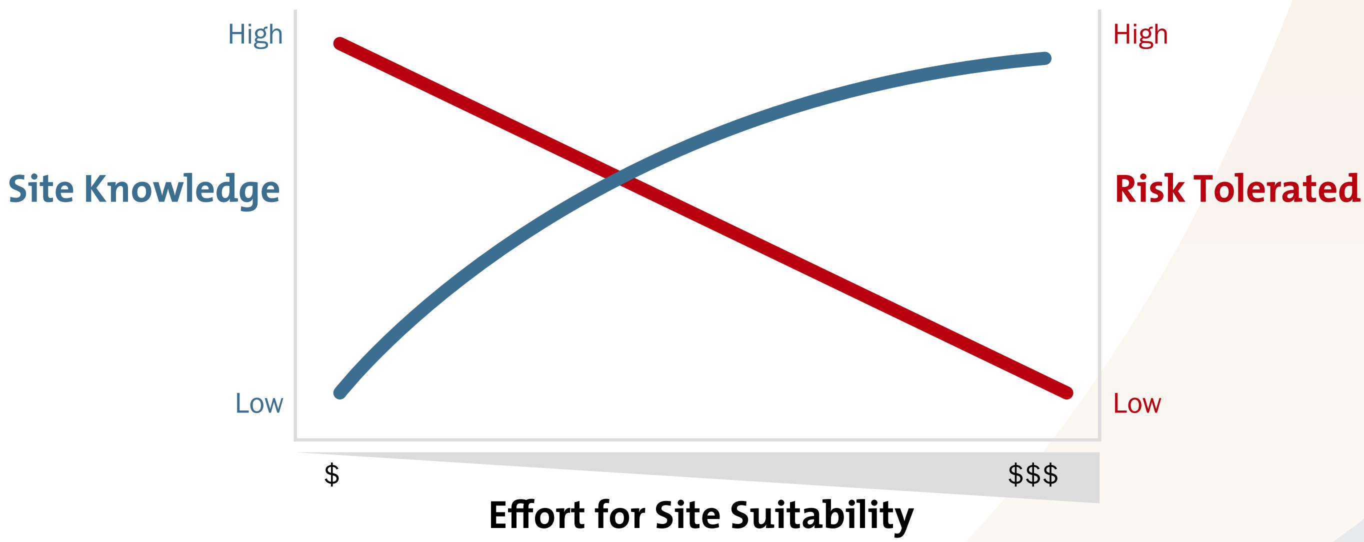
- A methodology for assessing site suitability and GHX options by developing an owner led concept for system deliverables and a step by step evaluation process. The evaluation is broken down into three stages:

  Stage 1 – a “desktop” style assessment with site visit which gathers and reviews all available information and makes estimates where site specific properties are unknown.

  Stage 2 – intrusive testing to confirm estimated site specific properties and construction (drilling) feasibility of installing GHX at the site. This gathered data is used to review and confirm conclusions from the Stage 1 assessment.

  Stage 3 – where required further pre-design work to better define complex projects can be carried out or environmental assessments or other regulatory driven studies can be completed.

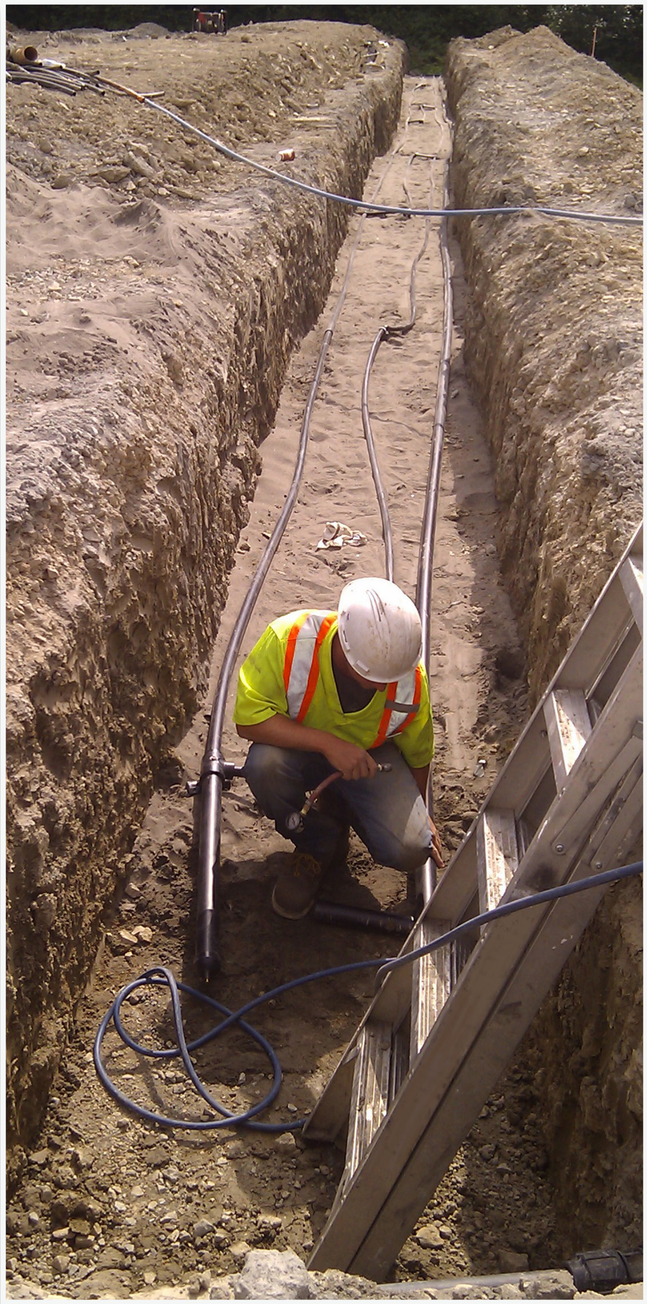
Figure 2: The Relationship between Research and Risk



Early efforts to increase knowledge about your site and its opportunities and limitations, while requiring upfront investment, reduce the risk of overdesign and change orders at the later , more costly, stages of construction and performance verification.

- The specific requirements for other GHX options and hybrid systems and their suitability assessment
- A list of assessment criteria and how to evaluate them
- A summary of regulatory considerations
- Technical references and resources relating to site suitability and system selection
- A description of the components in a geoexchange system and the various types of GHX options
- Guidance on the approach to optimising the GHX design so that it meets the energy needs of the project without entailing excessive capital costs
- A summary of the variation in climate, geology and hydrogeology across BC and its impact on GHX selection and design
- Guidance on assessing other site specific considerations and constraints such as space availability for GHX installation, environmental impacts, other nearby systems, and the balance of heating and cooling loads on the GHX

Verifying borehole depth using a dip tape



Vertical closed loop GHX - pressure testing

Checklist A: Part 1 – Assessing Site Suitability and Ground Coupling (GHX) Options

	Sub Categorised	Owner/CP	GHX Engineer	Mechanical Engineer	GHX Contractor	Mechanical Contractor	Commissioning Agent	Documentation Reference (1,2,3)
	Success Criteria							
❍	Define success criteria in terms of energy loads served, cost of energy, capital cost limits or other aspects	x						
❍	Identify project go/no-go matrix (maximum payback period, minimum acceptable rate of return (MARR), other sustainability or social drivers)	x						
	Site Geology & Hydrogeology							
❍	Understand and document the anticipated geology of the site and its impact on GHX type		x					
❍	Estimate from published sources and previous relevant tests the ground thermal properties through to construction depth (conductivity, diffusivity, temperature)		x					
❍	Research the presence of any aquifer(s) at the site and evaluate its effect on the GHX type and design		x					
❍	Evaluate the hydrogeologic properties of aquifers (type, depth, thickness, recharge, gradient, transmitting capacity)		x					
	Site Information							
❍	Define site location and plan, showing property boundary;	x						
❍	Define building or development concept (size, footprint and use; architectural renderings);	x						
❍	Define area availability for GHX around the planned building(s)	x	x					
❍	Obtain development schedule for the project;	x						
❍	Determine legal considerations (restrictions, covenants, easements);		x					
❍	Obtain Topographic maps;		x					
❍	Obtain bedrock and surficial geology maps;		x					
❍	Review air photos (or images from an on-line source such as Google Earth)		x					
❍	Obtain plans showing municipal utility services (water, sewer, gas, electric, cable, other)		x					
❍	Obtain plans showing industrial liquid pipelines or effluent (sewage treatment, process effluent, mine dewatering, etc.)		x					
❍	Review well records and aquifer databases (Ministry of Environment)		x					
❍	Review municipal zoning maps showing lot boundaries and easements		x					
❍	Obtain geotechnical, geological, hydrogeological or contaminated site reports on or near the subject area		x					
❍	Review reports or records from nearby geoexchange systems in place		x					
❍	Assess potential for on- or off-site contaminants of concern (previous studies, environmental consultant, BC OnLine, etc)		x					
❍	Consult with drillers familiar with conditions on or near the site		x					
❍	Conduct site reconnaissance visit		x					
	Energy Data							
❍	Identify GHX intent (heating, cooling or both, domestic hot water, or some other use);	x	x	x				
❍	Obtain or estimate building heating and cooling loads			x				
	Stage 1 - GHX Assessment							
❍	Compile plausible list of GHX options and assess against known facts and success criteria		x					
❍	Assess GHX capital costs		x					
❍	Evaluate construction constraints and appropriate construction methodology		x					
❍	Recommend best option GHX concept and review against original success criteria		x					
❍	Make go/no-go decision to proceed to next stage	x						
	Stage 2 - Intrusive Testing							
❍	Design a site testing programme to take into account extent of site, site variability and complexity of project		x					
❍	Conduct drilling, testing and sampling of the site		x		x			
❍	Review Stage 1 GHX assessment results against gathered site data - re-evaluate outcomes		x					
❍	Make go/no-go decision to proceed to next stage	x						
	Pre-design and Regulatory							
❍	Conduct further pre-design work as dictated by the project requirements		x					
❍	Complete Environmental Assessment or other regulatory driven activities as required	x	x					
❍	Make go/no-go decision to proceed to next stage	x						

Party Concerned*: Owner/CP, GHX Engineer, Mechanical Engineer, GHX Contractor, Mechanical Contractor, Commissioning Agent

** We have listed the parties most closely involved with the GHX. Other building design team members may need input via the CP/Owner. The CP is often the architect.*

Summary A: Part 1 – Assessing Site Suitability and Ground Coupling (GHX) Options

System Name:

Party Responsible	Name	Title	Signature
Owner			
GHX Engineer			
Mechanical Engineer			
GHX Contractor			
Mechanical Contractor			
Commissioning Agent			

Document References	Title	Date	Attached?
1)			❍
2)			❍
3)			❍
4)			❍
5)			❍
6)			❍
7)			❍

Notes:

Part 2 – Design

GOALS

This guideline builds on Part 1 - Assessing Site Suitability and Ground Coupling Options and provides design guidance (primarily for closed loop vertical GHX applications). The intent is to highlight standard methods and other design reference documents and describe a best practice approach to the detailed design process.

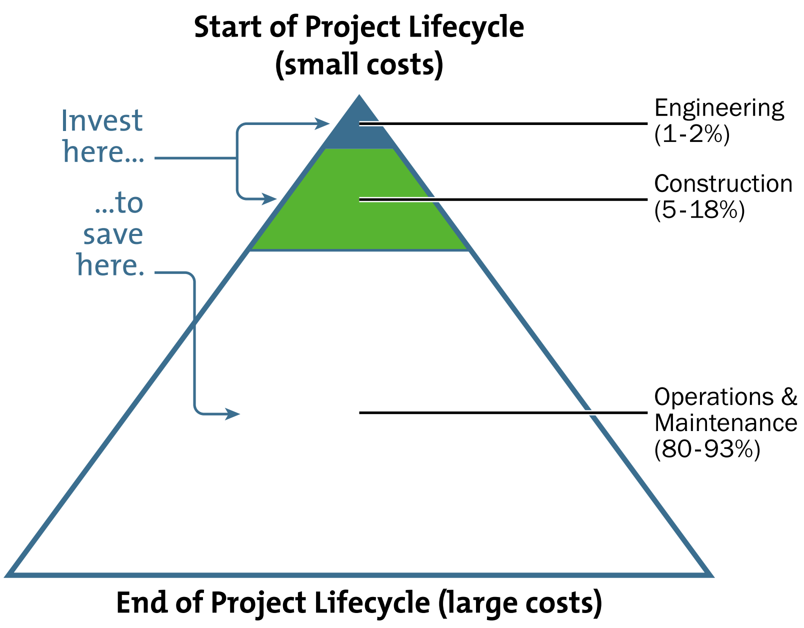
KEY BENEFITS

Information in this guideline will help the designer to specify a robust GHX design which meets the needs and objectives of the owner and provides sustainable long term operation while optimising capital cost investment. This will ensure the life-cycle economic objectives are met through a thorough design process.

SUMMARY OF CONTENTS

- Integrating geoexchange into the building concept and coordinate with the building mechanical system design
- Factors affecting successful geoexchange applications including the importance of a thorough site assessment process, careful and complete identification of energy loads and the importance of considering energy efficiency in all aspects of the building mechanical system to realise the benefits of the high efficiency ground source
- Variation in climate, geology and hydrogeology across BC and its impact on GHX design
- Optimum building mechanical configurations
- Various types of ground heat exchangers
- Thermodynamic response relationship between the building and the GHX and how this affects the design process
- A step-wise approach to Pre-Design and Detailed Design
- Additional industry-leading reference material for design methodology
- Strategies for dealing with common design challenges such as unbalanced loads, heating and cooling dominated hybrid options and space constrained sites
- Regulatory and environmental considerations
- Common geoexchange system shortfalls and how to avoid them

Figure 3: Proportions of Project Costs and Where to Save



It is unwise to pay too much, but it is worse to pay too little. When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing you bought it to do.

John Ruskin (1819-1900), Author & Scientist, Oxford University

HDPE U-bend, ready to be installed

Energy Transfer Station

Vertical closed loop system being trenched ready for headering

Checklist B: Part 2 – Design

		Party Concerned*						
	Sub Categorised	Owner/CP	GHX Engineer	Mechanical Engineer	GHX Contractor	Mechanical Contractor	Commissioning Agent	Documentation Reference (1,2,3)
	Gather Design Input Data							
❍	Results and information from Site Suitability Assessment and GHX Coupling Options	x	x					
❍	Obtain detailed peak and annual building heating and cooling loads to be served by the GHX, from building energy modelling.		x	x				
	Set Design Criteria							
❍	Set out design criteria to ensure "whole system" efficiency and optimise interaction with the building mechanical systems	x	x	x				
❍	Identify a quantifiable building energy performance target.	x		x				
❍	Define constraints on GHX such as space availability, capital cost, schedule, construction and installation constraints	x	x					
	Design							
❍	Obtain the services of a specialised GHX engineer with the requisite qualifications, including earth science expertise	x						
❍	Use recognised design software based on published design theory and actual system performance		x					
❍	Reference and implement applicable standards covering design of GHX systems (CSA448, ASHRAE etc)		x					
❍	Use site specific, measured thermal properties and energy loads in the design input		x					
❍	Evaluate the long-term sustainable operation of the GHX		x					
❍	Complete sensitivity analysis to account for foreseeable variations in site conditions, energy loads and system operation		x					
❍	Ensure internal and ground piping arrangement minimises pumping power requirements (to ASHRAE performance targets)		x	x				
❍	Coordinate internal and external system components and configuration to avoid scope gaps and optimise performance		x	x				
❍	Include features required for successful commissioning of the GHX and mechanical systems		x	x				
❍	Include sufficient instrumentation and monitoring points for ongoing performance monitoring and troubleshooting		x	x				
❍	Issue a complete and comprehensive engineering-class design drawing and construction specification package		x					
❍	Include system information such as energy capacity, design flowrates and temperatures on the design drawings		x					
❍	Ensure all design drawings are stamped by a qualified professional	x	x					
❍	Update cost estimate		x					
❍	Make go/no-go decision to proceed to next stage	x						

** We have listed the parties most closely involved with the GHX. Other building design team members may need input via the CP/Owner. The CP is often the architect.*

Summary B: Part 2 – Design

System Name:

Party Responsible	Name	Title	Signature
Owner			
GHX Engineer			
Mechanical Engineer			
GHX Contractor			
Mechanical Contractor			
Commissioning Agent			

Document References	Title	Date	Attached?
1)			❍
2)			❍
3)			❍
4)			❍
5)			❍
6)			❍
7)			❍

Notes:

Part 3 – Commissioning

GOALS

Part 3 describes best practices for commissioning geoexchange systems in commercial/institutional buildings. It outlines who should be involved at which stage of the process, the activities that should be completed, and the data to be recorded. It outlines preventative maintenance tasks and makes recommendations as to ongoing system monitoring protocols. The guideline covers likely troubleshooting issues and possible solutions

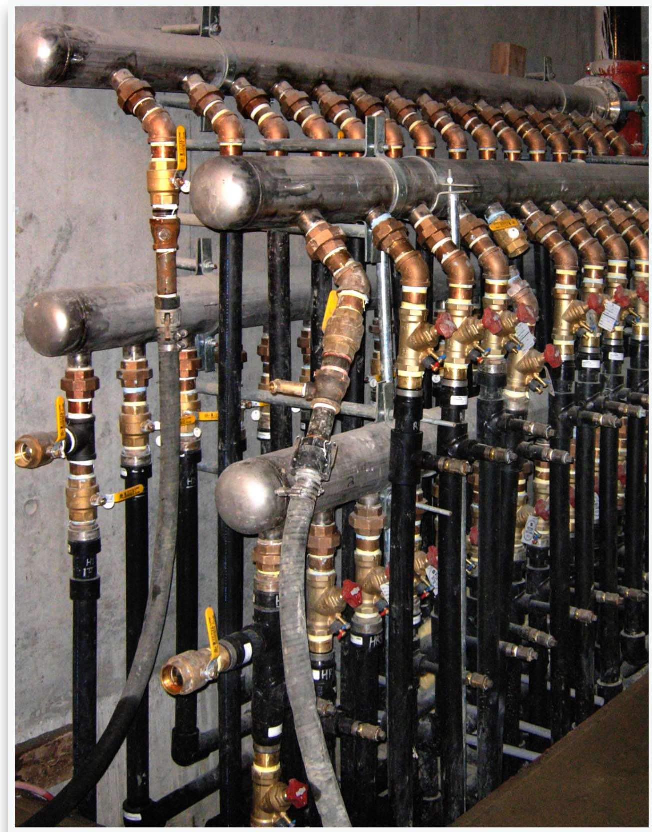
KEY BENEFITS

Spending the time and money to properly engineer, install and commission a system up front will ensure the system operates efficiently and in accordance with its design intent. This effort will pay for itself over the lifetime of the project. This guideline gives the owner the tools to assign clear responsibilities and accountability for all parties. Implementing a preventative maintenance plan and ongoing system performance monitoring can reduce overall lifecycle costs by allowing early intervention if system performance deteriorates.

SUMMARY OF CONTENTS

- Standardized example commissioning specifications
- Why and how to implement geoexchange commissioning and the benefits of a complete commissioning program
- Who needs to be involved in the commissioning process and their responsibilities
- Specialist requirements for commissioning geoexchange systems related to GHX type (open, closed loop, etc.)
- Proactive steps required at the pre-design, design and construction phase to facilitate commissioning activities and to ensure Quality Assurance during the construction phase
- A description of the procedures required in commissioning the GHX (flushing, purging, pressure testing, dynamic flow testing, balancing) and a step-by-step approach to each of these procedures and record sheets for recording test results
- Guidance on mechanical equipment and controls system commissioning
- The benefits of preventative maintenance and a check list for a preventative maintenance program
- Some common troubleshooting issues and suggestions for resolution
- Recommendations for an ongoing performance monitoring plan
- Additional reference material for commissioning and related activities

Checklist C relates to the commissioning of the geoexchange ground loop only. It is recognised that the commissioning of the complete building mechanical system would encompass many more tasks.



Mechanical room GHX manifolds

Checklist C: Part 3 – Commissioning

Sub Categorised	Party Concerned*: Owner/CP	GHX Engineer	Mechanical Engineer	GHX Contractor	Mechanical Contractor	Commissioning Agent	Documentation Reference (1,2,3)
Planning							
Include commissioning time in the overall schedule	x					x	
Make budget allowances for commissioning activities	x						
Engage the appropriate professional services for commissioning activities - check for GHX experience	x						
Engage Hydrogeologist for commissioning of open loop systems	x						
Arrange for oversight by Commissioning Agent where required by project complexity	x						
Develop requirements for project in terms of operator involvement, system performance and monitoring parameters	x						
Establish the requirements for substantial completion	x	x	x				
Establish commissioining document retention and distribution	x					x	
Construction QA							
Record construction information such as verified borehole depths, grout sample test results, as-built header configurations.		x		x			
Conduct periodic site visits to verify system quality and installation as per design		x					
Complete grout thermal conductivity testing		x		x			
Pre-Commissioning							
Establish required commissioining documentation and test record sheets	x					x	
Define responsibilities for each party	x					x	
Develop detailed commissioning plan and schedule	x	x	x			x	
Commissioning							
Perform commissioning process activities and complete all required testing -				x		x	
Flushing				x		x	
Purging				x		x	
Pressure Testing				x		x	
Dynamic Flow Testing				x		x	
Antifreeze Charging				x		x	
System Balancing				x		x	
Complete required documentation				x		x	
Complete mechanical plant commissioning					x	x	
Complete controls system end to end functionality tests				x	x	x	
Witness all commissioning activities and testing		x	x			x	
Documentation							
Provide as-built drawings		x	x	x	x		
Provide completed and reviewed commissioning documentation		x	x	x	x	x	
Provide balancing report,				x			
Document sequence of control and control system verification checks			x			x	
Provide O&M manual					x		
Provide commissioning report		x	x			x	
Provide Engineers Letter of Assurance.		x	x				
Post-Commissioning							
Provide operator training to owners requirements		x	x		x		
Start-up system and complete the initial operation phase.					x	x	
Verify substantial system completion		x	x				
Verify data monitoring and logging systems	x	x	x				
Develop and implement preventative maintenance programme	x	x	x				
Complete ongoing system performance monitoring and periodically re-assess system performance	x						

** We have listed the parties most closely involved with the GHX. Other building design team members may need input via the CP/Owner. The CP is often the architect.*

Summary C: Part 3 – Commissioning

System Name:

Party Responsible	Name	Title	Signature
Owner			
GHX Engineer			
Mechanical Engineer			
GHX Contractor			
Mechanical Contractor			
Commissioning Agent			

Document References	Title	Date	Attached?
1)			❍
2)			❍
3)			❍
4)			❍
5)			❍
6)			❍
7)			❍

Notes:

Part 4 – Procurement

GOALS

This guideline provides options for the most effective method of procurement for geoexchange systems under various contractual arrangements. It discusses the advantages of each method of system procurement and provides guidance on how to "engage the right people, on the right scope, at the right time" to allow delivery of a complete and as-per-design system. This guideline is written with the Coordinating Professional in mind.

KEY BENEFITS

All too often the current practice of procuring geoexchange systems leaves gaps in the scope, such that the owner does not achieve the energy performance or long-term system sustainability that they are seeking. Using the guidance in this document will help the owner procure a geoexchange system that meets their expectations in terms of energy performance and costs. Providing a consistent and complete set of information to bidders will ensure equal evaluation of bids against a level playing field. Having the right team members in the right positions, and clearly delineating responsibilities, will ensure delivery of a quality system to the required project schedule and design.

SUMMARY OF CONTENTS

- Standardized example specifications and terms of reference information
- Procurement options, their benefits and drawbacks, including
    - Design-Spec-Tender
    - Construction Management Led
    - Design-Build
- Specific methods for geoexchange procurement with consideration given to the scope division between the geoexchange contract and the building interior mechanical contract. This section includes key information requirements and team relationships and responsibilities.
- Procurement management pitfalls and how to avoid them
- A discussion on the bidding process and how to ensure transparency and consistency between parties
- A step-by-step flowchart for the procurement process
- Additional reference material for procurement processes

Checklist D relates to the procurement of the geoexchange ground loop only.

Open-loop Groundwater GHX Well Installation

Closed-loop vertical GHX air rotary drilling

Headering of a vertical closed loop GHX within a building footprint

Checklist D: Part 4 – Procurement

	Sub Categorised	Owner/CP	GHX Engineer	Mechanical Engineer	GHX Contractor	Mechanical Contractor	Commissioning Agent	Documentation Reference (1,2,3)
	Procurement Methodology							
❍	Decide upon the most appropriate procurement method for this project. Consider advantages and drawbacks for each approach and evaluate against project key success criteria	x	x					
❍	Ensure assignment of design, construction, quality control, and documentation responsibilities is well defined and avoids conflict of interest	x						
❍	Develop a transparent methodology for bid review and assesment, focusing on key success criteria for the project	x						
❍	Pre-qualify bidders	x	x					
❍	Ensure the bidding process is structured to avoid conflicts of interest	x						
❍	Construct the RFP to be specific, include the appropriate level of drawings and specifications or site assessment and design input data, include key success criteria such as system energy performance	x	x					
❍	Complete an objective evaluation of all bids against key success criteria	x	x					

Party Concerned* columns: Owner/CP, GHX Engineer, Mechanical Engineer, GHX Contractor, Mechanical Contractor, Commissioning Agent.

** We have listed the parties most closely involved with the GHX. Other building design team members may need input via the CP/Owner. The CP is often the architect.*

Summary D: Part 4 – Procurement

System Name:

Party Responsible	Name	Title	Signature
Owner			
GHX Engineer			
Mechanical Engineer			
GHX Contractor			
Mechanical Contractor			
Commissioning Agent			

Document References	Title	Date	Attached?
1)			❍
2)			❍
3)			❍
4)			❍
5)			❍
6)			❍
7)			❍

Notes:

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FUNDING PARTNERS

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