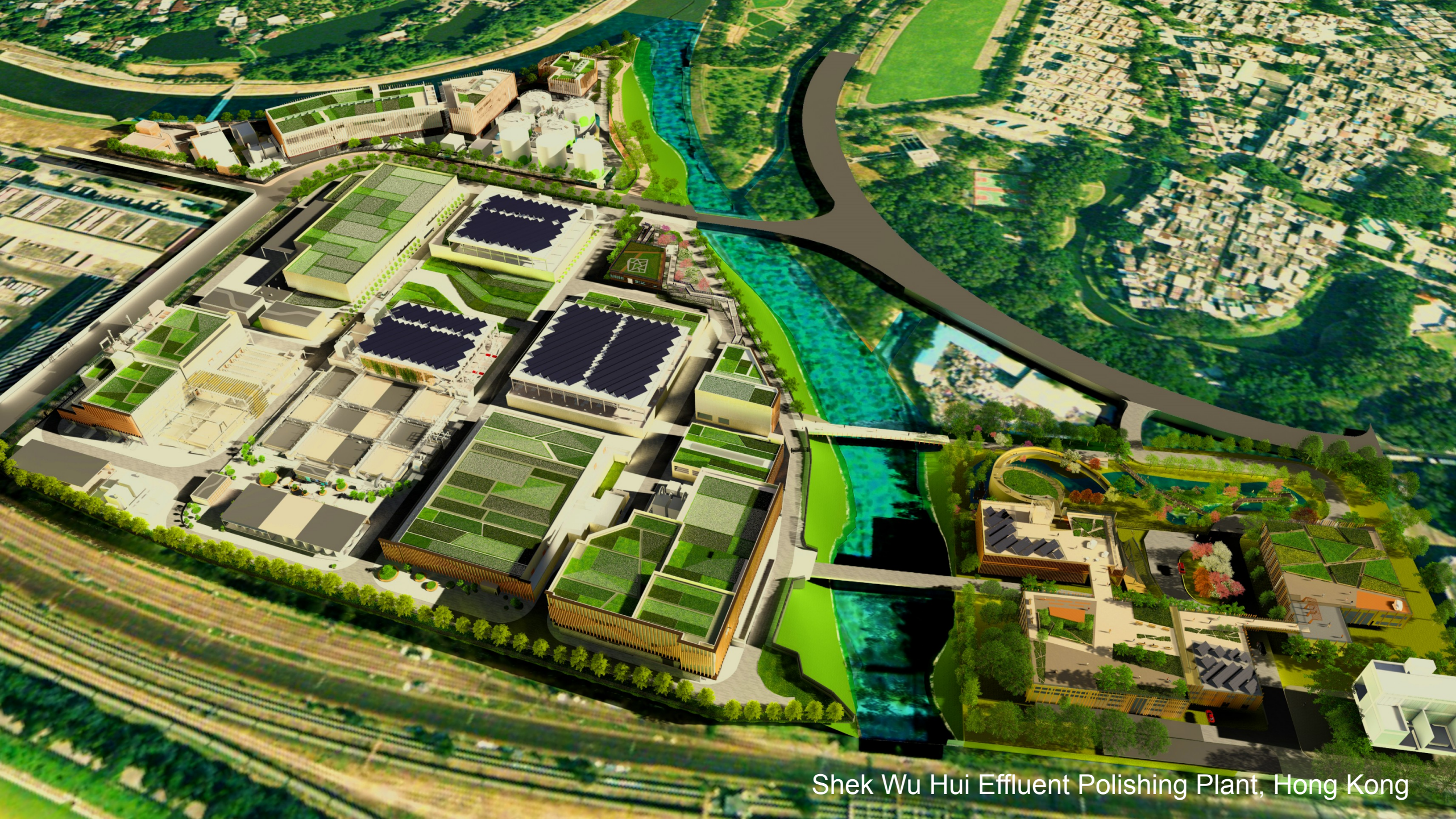
渠務署

Drainage Services Department



Shek Wu Hui Effluent Polishing Plant, Hong Kong

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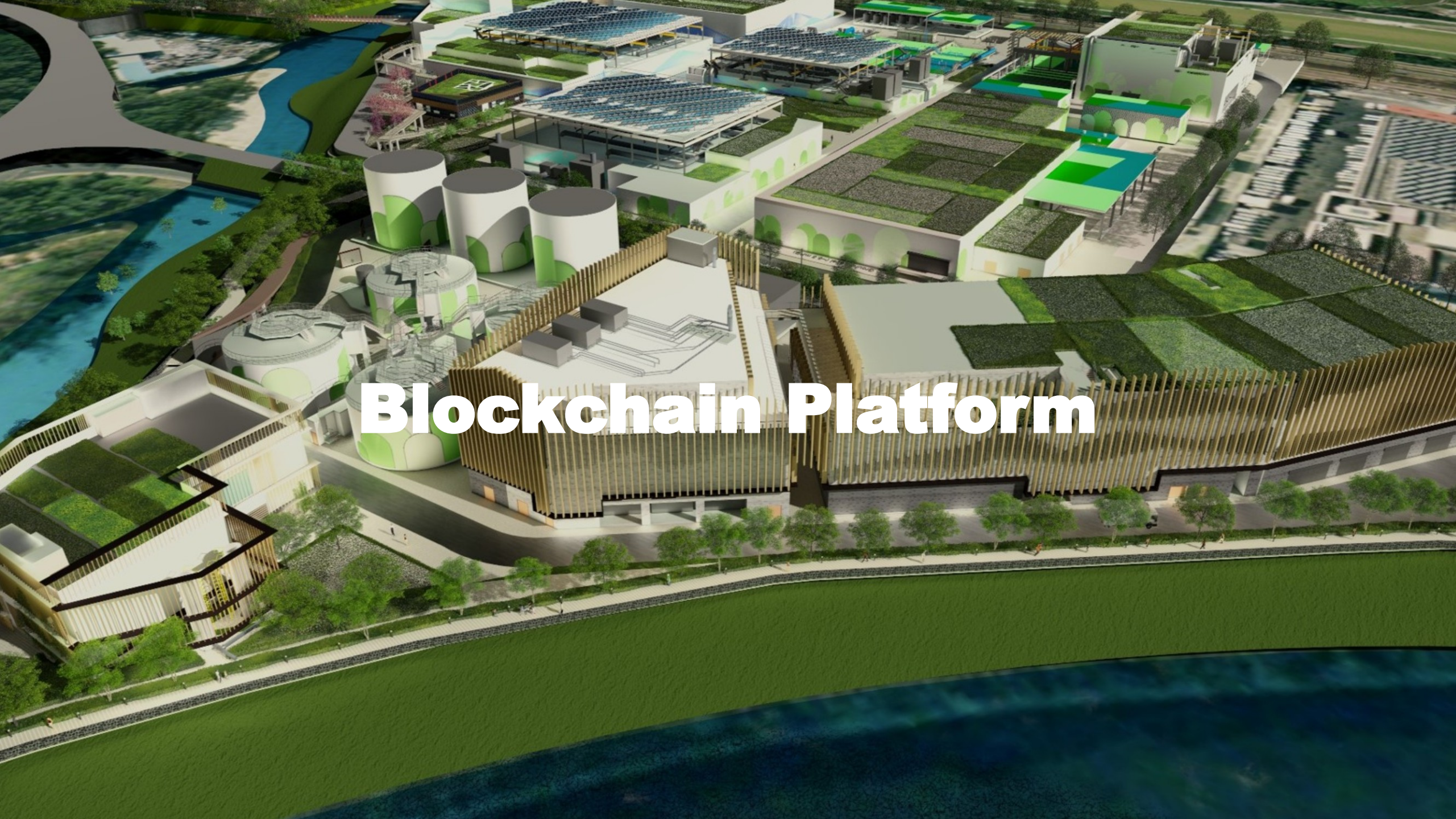
Blockchain Platform


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2023

Blockchain Platform

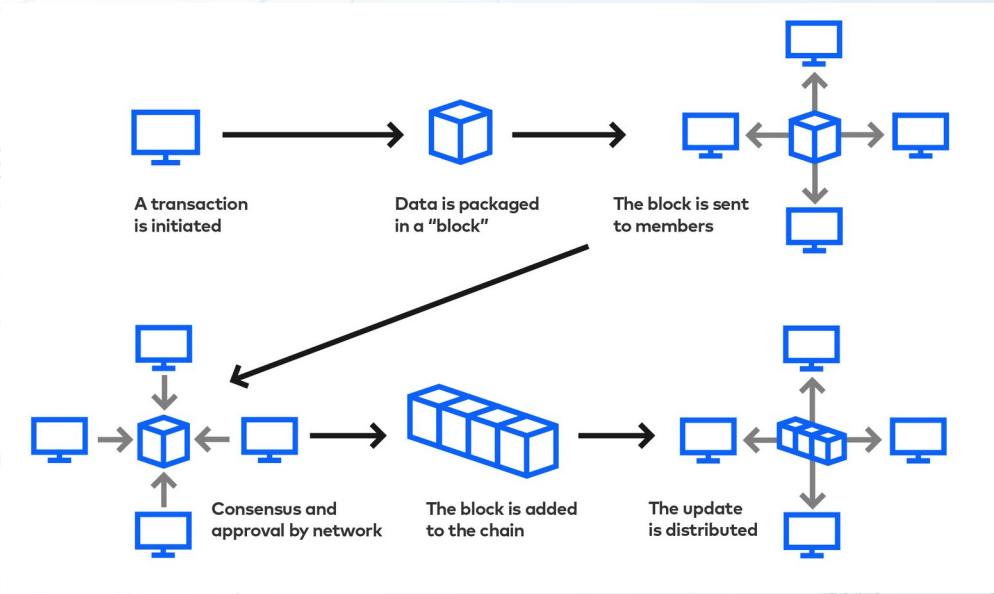
For Construction Workflow Collaboration

Shek Wu Hui Effluent Polishing Plant, Hong Kong

What is **Blockchain** ?

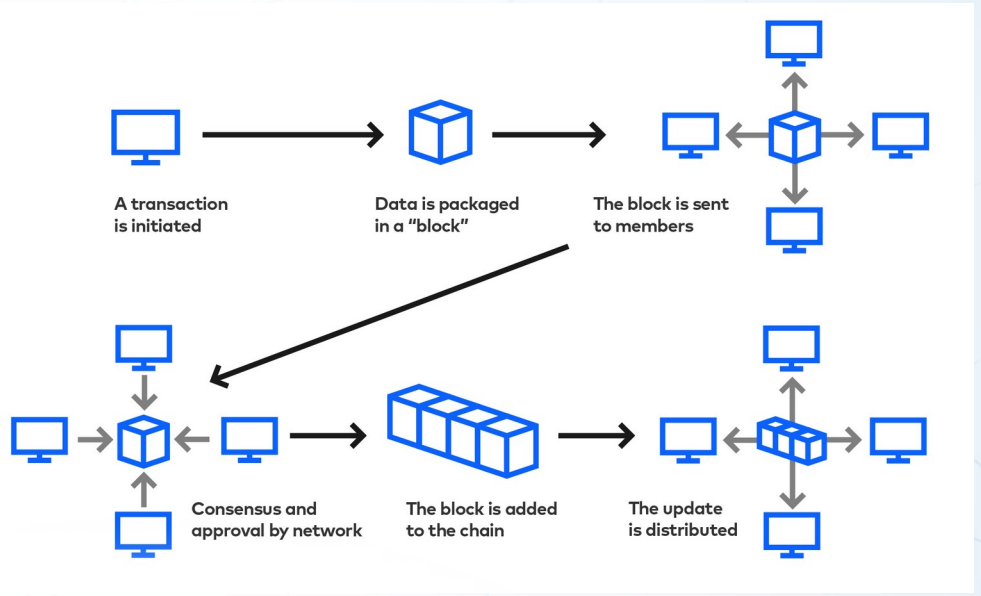
A Blockchain is a distributed database or ledger that is shared among the nodes of a computer network and collects information together in groups, known as **blocks**, that hold sets of information.

Blocks have certain storage capacities and, when filled, are closed and linked to the previously filled block, forming a chain of data known as the **Blockchain**. Each block contains a hash, hash of the previous block, a timestamp, and transaction data.



What is **Blockchain** ?

- Block -> Chain
- Open
- Ledger
- Peer-to-Peer Network
- Decentralised
- Consensus



Storing Data & Documents

Metadata as text on Blockchain

Documents as files on Inter-Planetary File System (IPFS)

- Every file added to IPFS is given a unique address derived from a hash of the file's content. This address is called a Content Identifier (CID) and it combines the hash of the file and a unique identifier for the hash algorithm used into a single string.

- If a document content is modified, the original CID will no longer be valid. The original CID stored on the Blockchain will not point to a valid document. In other word, if a CID on Blockchain can return a document, the document is proof to be the original.

Benefits of Blockchain

Shared & Distributed

Blochchain technology offers a shared and distributed ledger that is open for all users

Increase Network Capacity

Much more capable than the traditional network

Immutable

The transaction cannot be undone if already on the Blockchain

Faster Settlement

Way faster than manual process of validation

Decentralised

Not dependable on server based technology and no one has authority over the system

More Secured

More secured than the traditional methods

Problems in Construction Industry

Poor Traceability

- Numerous workflows and paper forms
- Difficult to “traceroute” the accountability
- Easy to lose the file
- Hard to search for information

Poor Data Management

- Many stakeholders e.g., client, design consultants, supervising officers, main contractor, sub-contractors, suppliers and maintenance authorities
- Construction supervision in discrete processes
- Lack of a common data management platform

Problems in Construction Industry

Every stakeholder has their own system and dataset

- Single point of failure
- Data Integrity
- Lack of data transparency

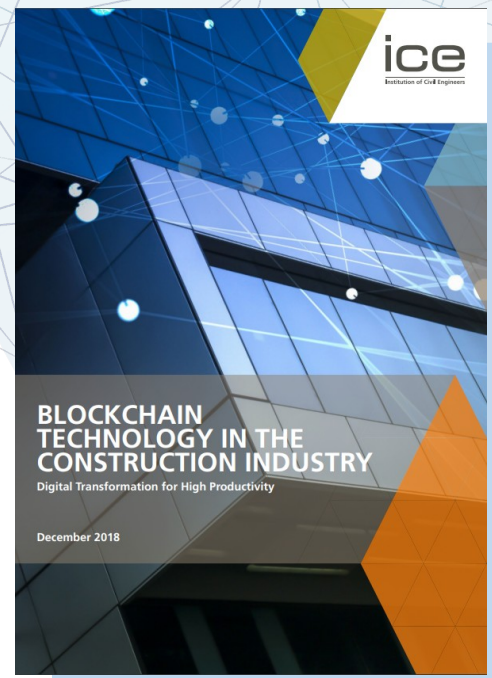
Every contract has it owns system policy and data format

Lack of common data standard for communication and collaboration

Blockchain in Construction Industry

Digital Transformation for High Productivity

Published the ICE report in December 2018 to explore Blockchain application in construction industry



Potential Application Areas

- Smart Contracts
- Project Collaboration
- Procurement
- Supply Chain Management
- Smart Asset Management

SWHEPP Blockchain
Project Background

- First innovative project applying Blockchain technology to construction site for operation monitoring in Hong Kong
- Taking the Shek Wu Hui Effluent Polishing Plant (SWHEPP) project as a pilot
- Phase 1 commenced in June 2020 - Collaboration with HKU, UST and CityU for more in-depth study and research on the science behind Blockchain and its application to digital construction workflow
- Phase 2 commenced in April 2021 - Under the support of DSD, AECOM and Chun Wo partnered up to further develop the Blockchain Platform for 4 Contracts to be used in SWHEPP

渠務署
Drainage Services Department

AECOM Imagine it. Delivered.

俊和 Chun Wo

CityU

Features of **SWHEPP Blockchain** Platform

Data Traceability

Process data from different contracts like Request for Inspection & Survey Check (RISC) forms can be **traced for inquiry and inspection at any time**, also **prohibited from amendment and deletion**.

Workflow Collaboration

Information in different systems like Digital Works Supervision System (DWSS) can be exchanged via Blockchain Standard **Application Programming Interface (API)**, systems become connected and multidimensional.

File System Performance

By using peer-to-peer solution (IPFS) enabling users to access and share files without relying on centralised server, it can transfer 71.6% faster than traditional client-server approach in large size file transmission.

Features of **SWHEPP Blockchain** Platform

Data Transparency

Process data includes raw data, history, documents, key person, related parties on the Blockchain can be viewed by all the stakeholders in a more transparent and trustable way.

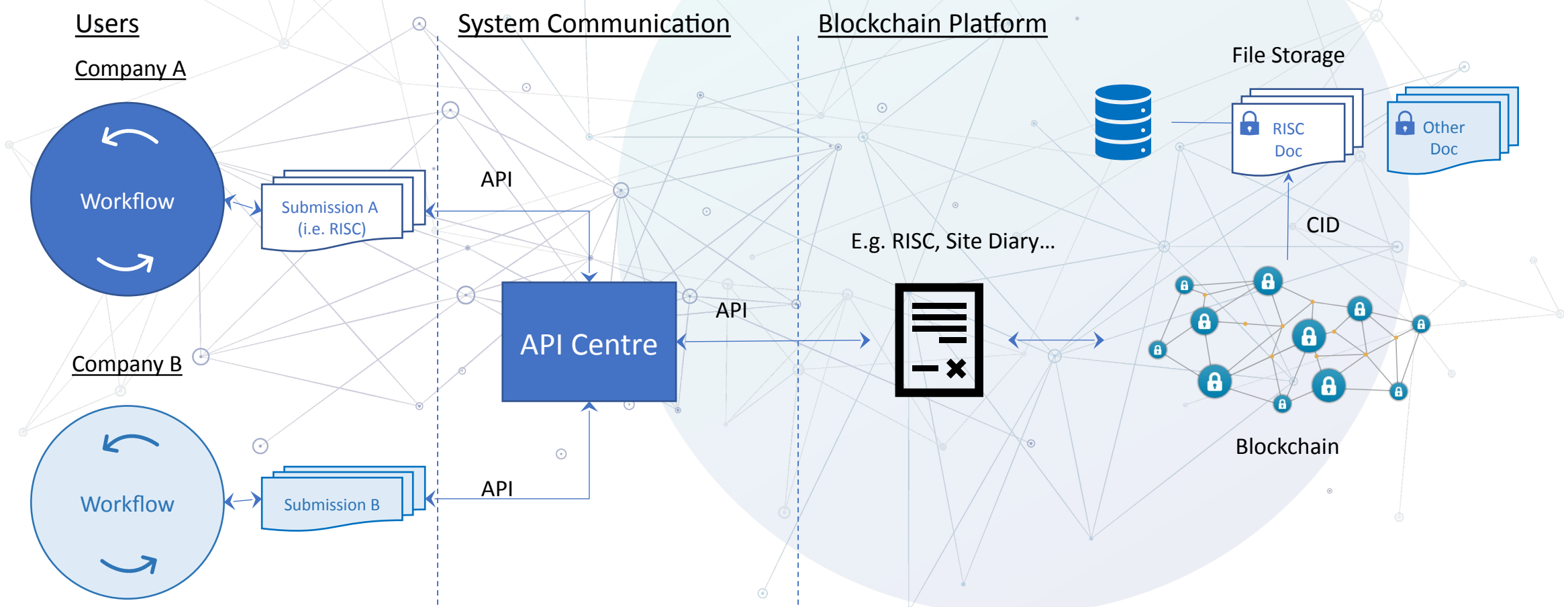
High Scalability

The Blockchain application and approach can be applied in other DSD projects or even other construction projects.

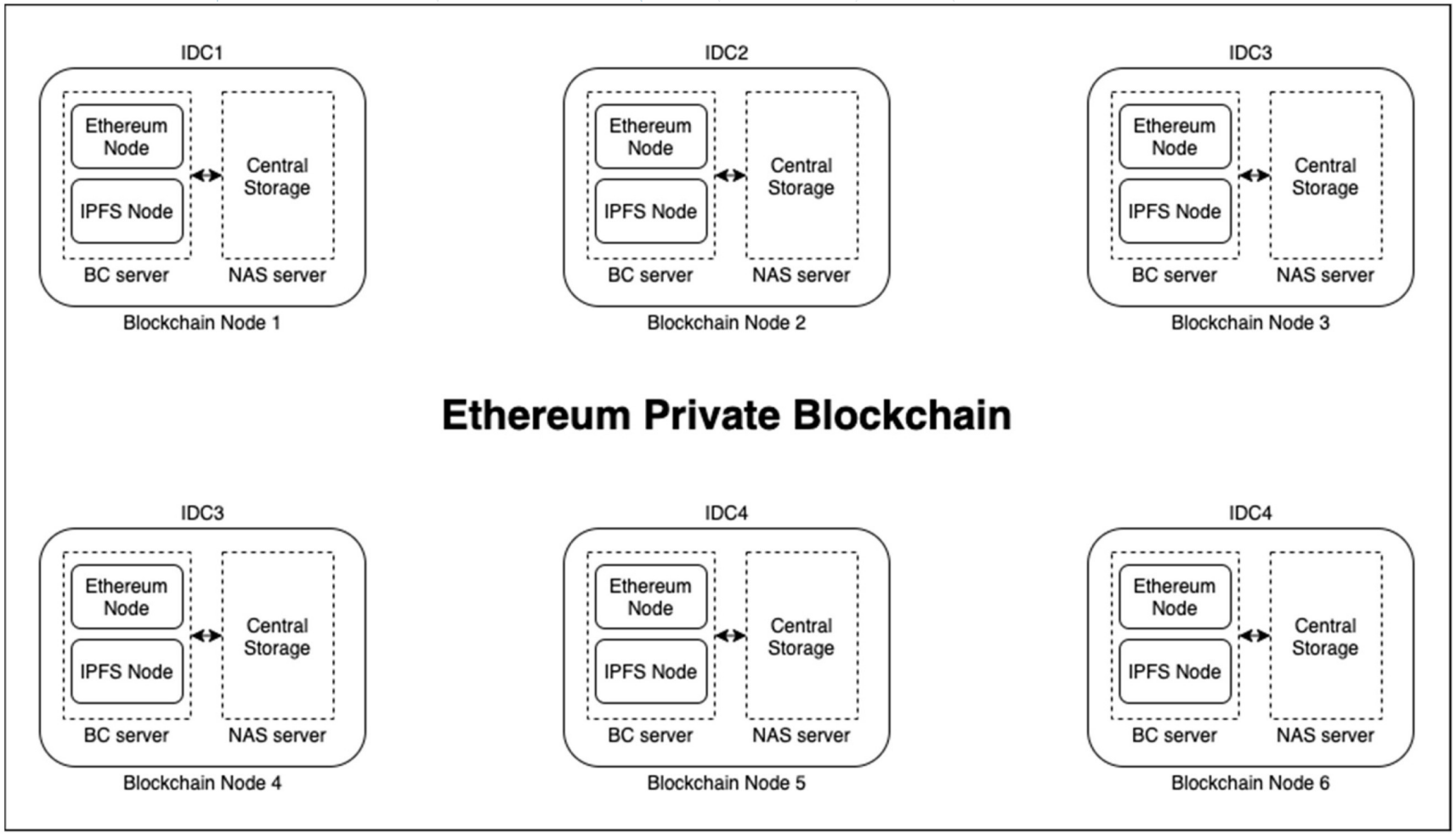
A Centralised Platform

A centralised Blockchain Platform with distributed private infrastructure is provided to stakeholders to view the Blockchain data according to their permissions and roles in the Blockchain. The Blockchain Platform is able to consolidate different data sources for different contracts.

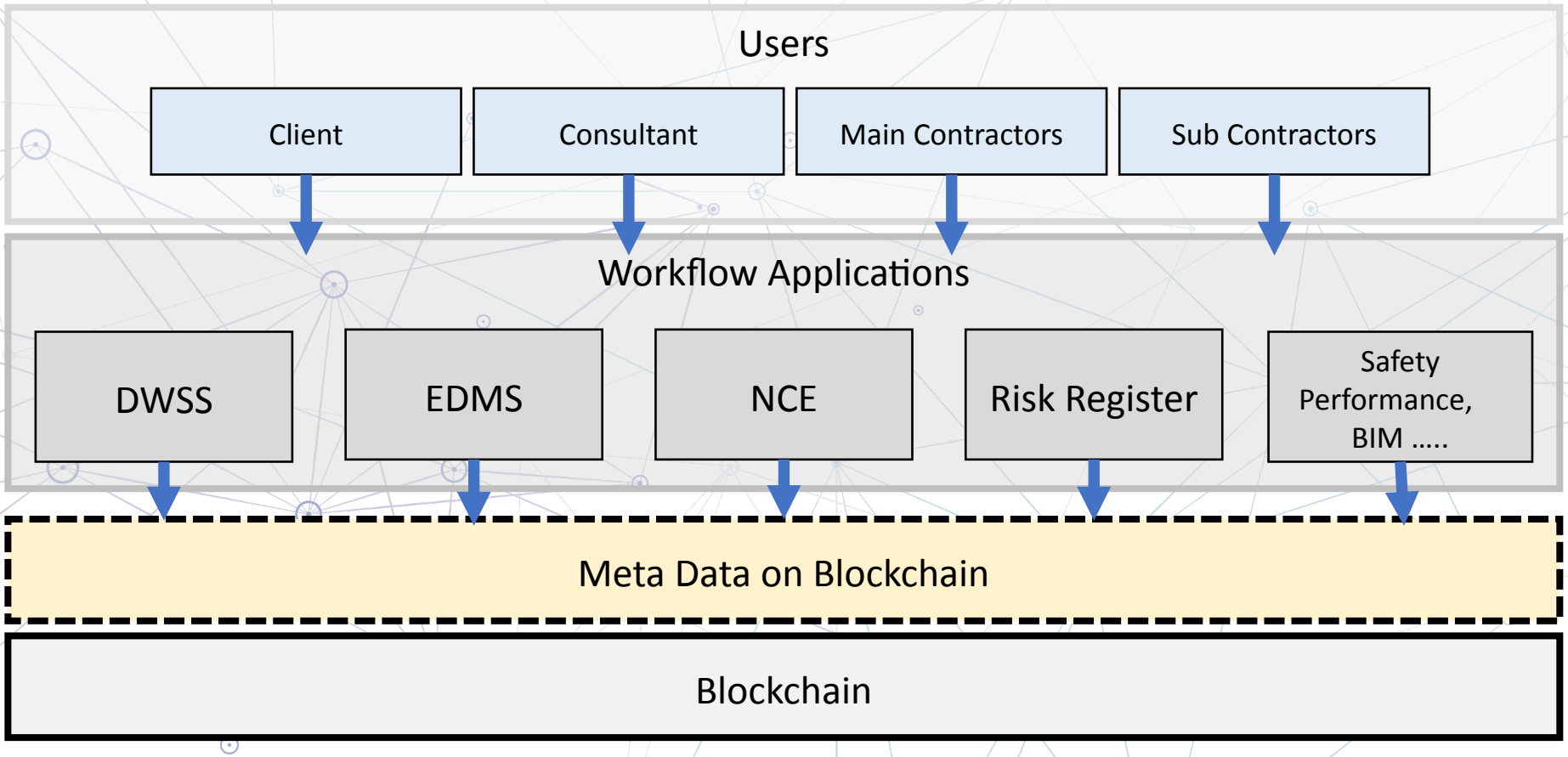
SWHEPP Blockchain Architecture



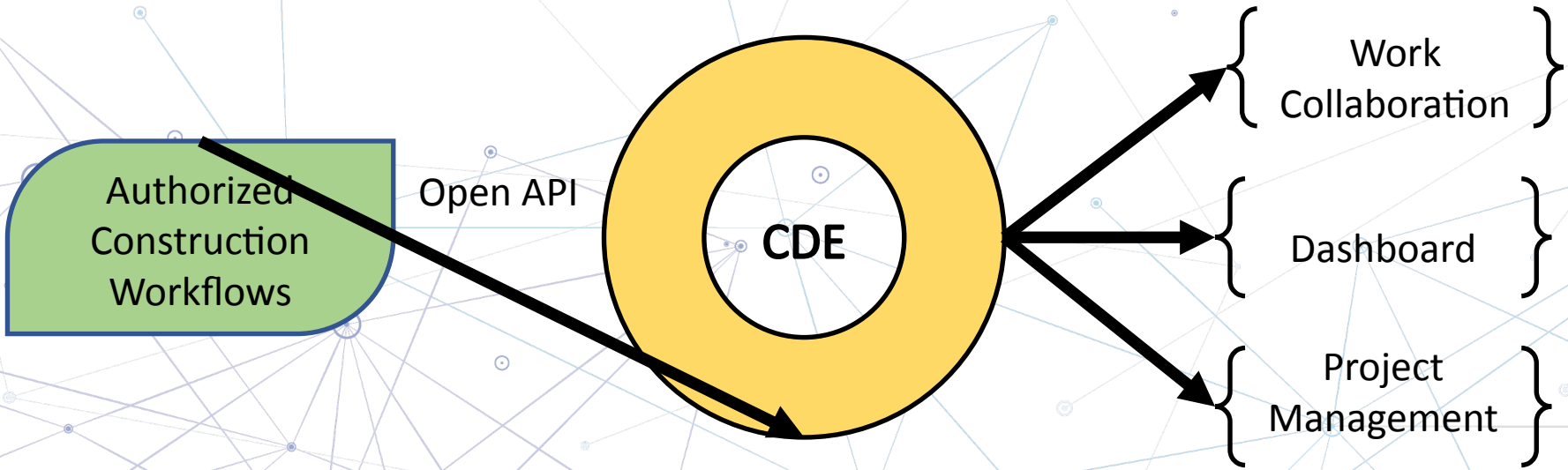
SWHEPP Blockchain Architecture



Construction Workflow on **Blockchain**

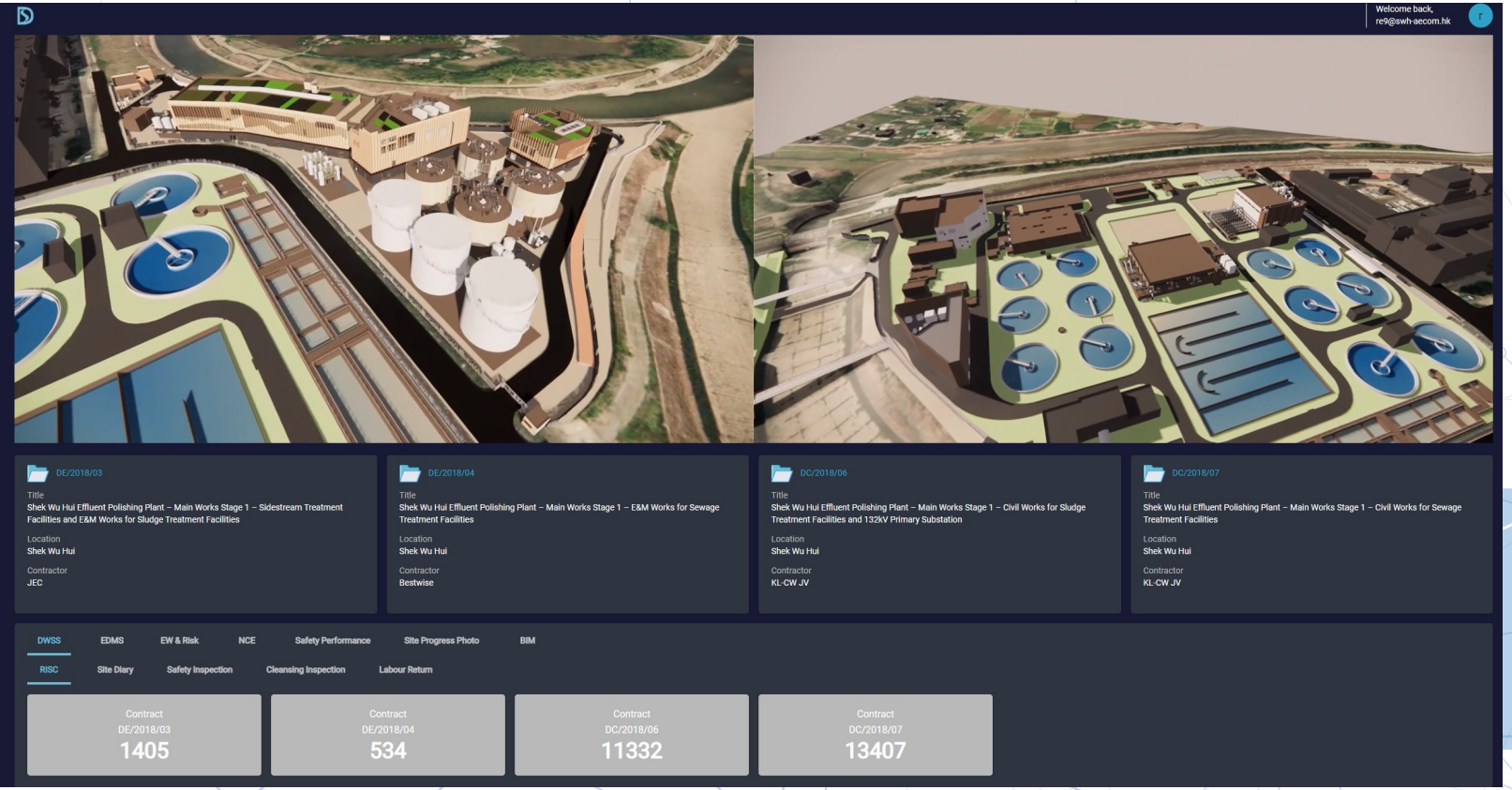


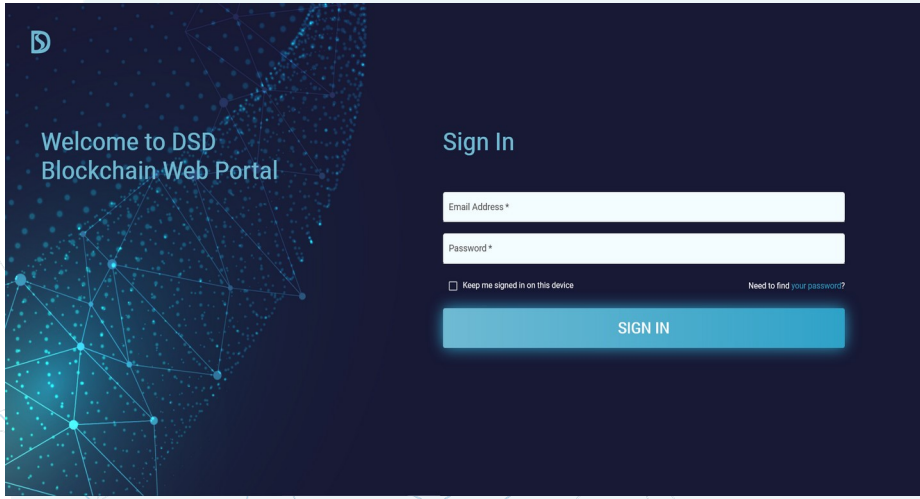
Blockchain as Common Data Environment



- The Open API design in the Blockchain solution allows authorized systems from client, consultant, contractors and sub-contractors to submit and share data among each others
- Data set is defined for each workflow. They combine and serve as “Common Data Environment”
- CDE can act as the single source of truth for work collaboration, dashboard and project management

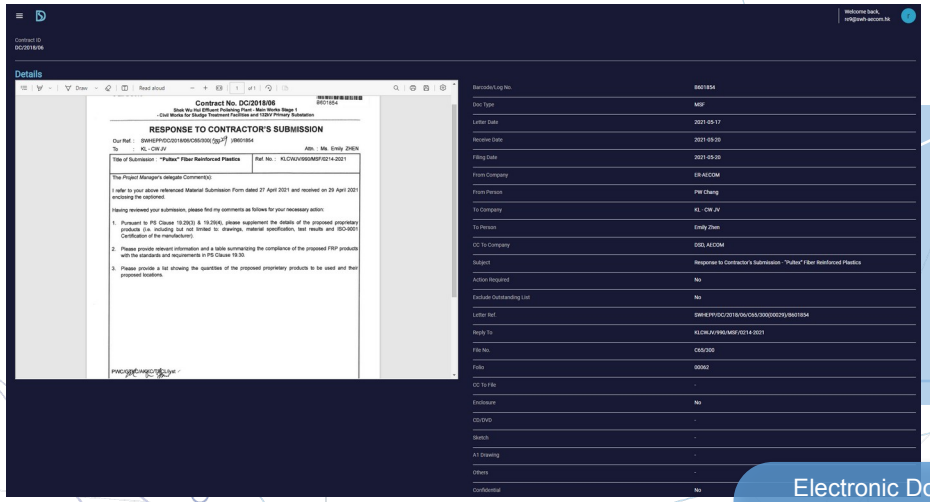
SWHEPP Blockchain Platform User Interface





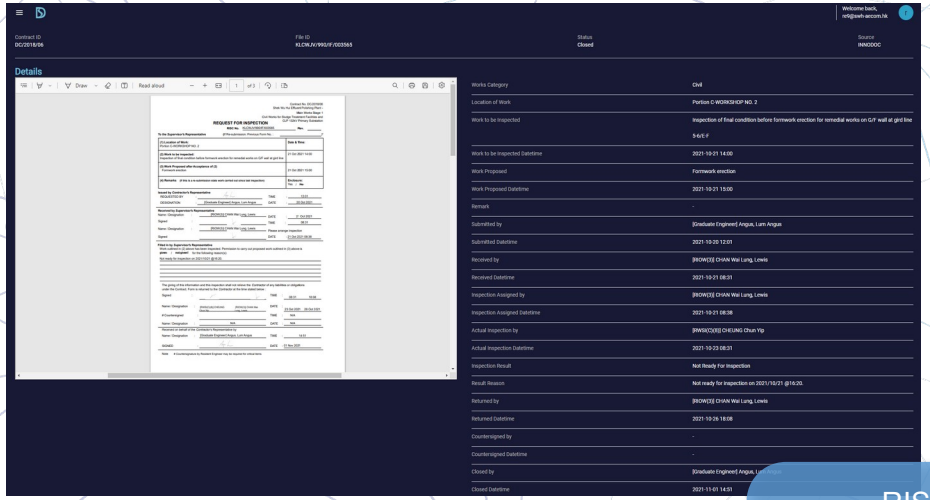
Centralised Platform for 4 contracts on ONE graphical user interface to consolidate different records for different contracts

SWHEPP **Blockchain** Platform User Interface



Electronic Document Management System

With using the API, Blockchain Platform becomes more multidimensional to get access on different data from various software applications, e.g. DWSS and BIM360

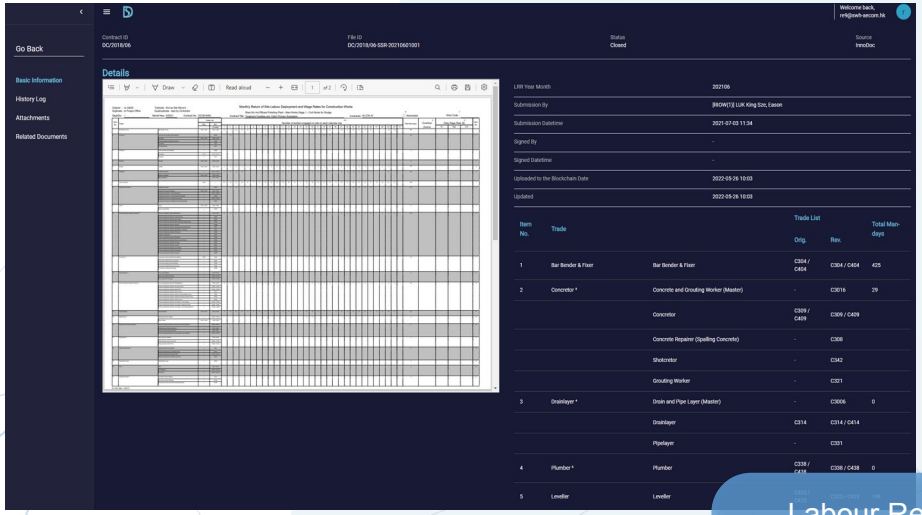


RISC

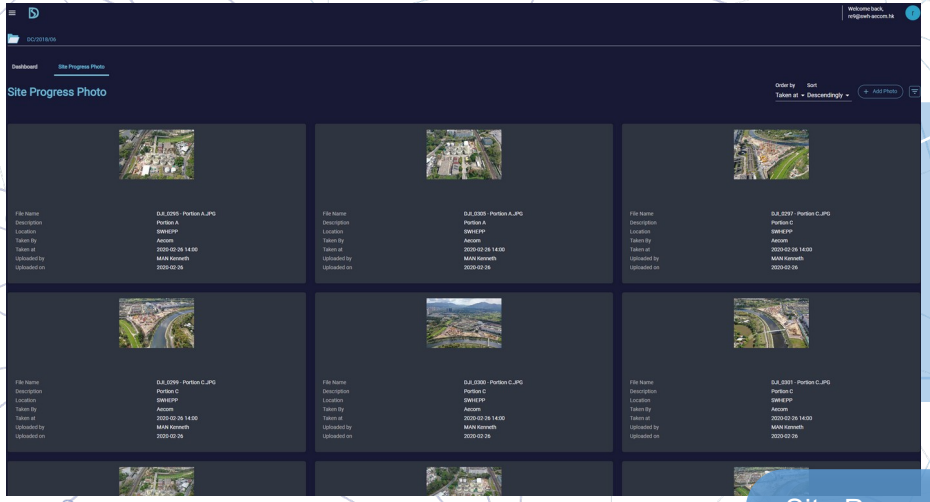
BIM

SWHEPP Blockchain Platform User Interface

Site Diary



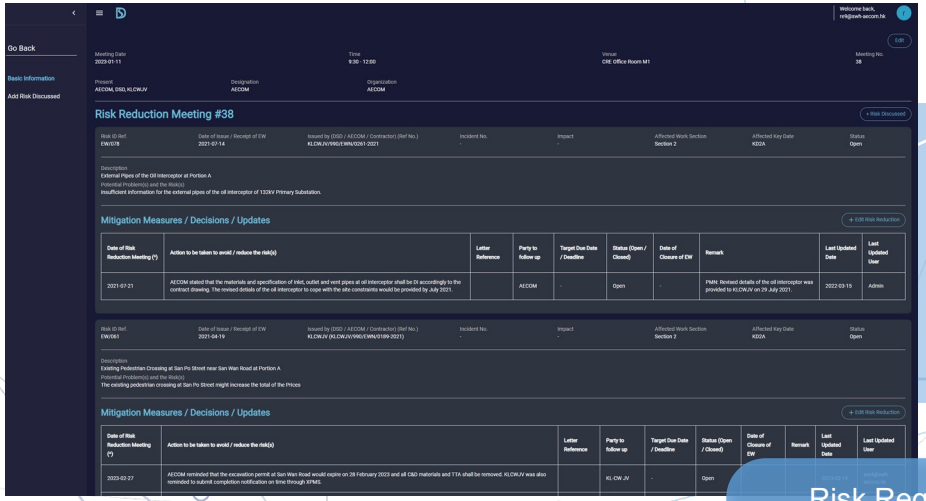
Labour Return



Site Progress Photo

Data are immutable with timestamp on Blockchain Platform and access records at any time to increase data traceability

SWHEPP Blockchain Platform User Interface



Blockchain Platform covers the workflows used in the project from different parties such that workflow collaboration can be facilitated via Blockchain for construction data exchange

Risk Register

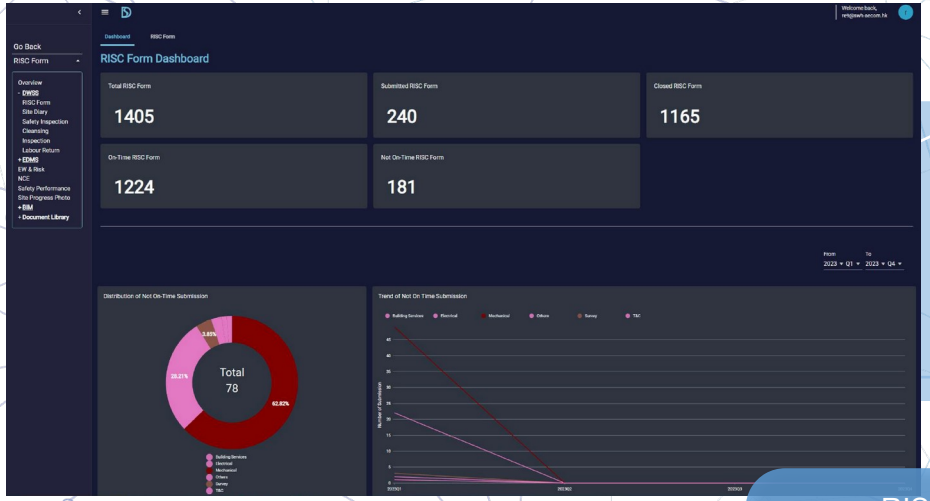
Notification of Compensation Event

Safety Performance

SWHEPP **Blockchain** Platform User Interface

Electronic Document Management System

Labour Return



RISC

With dashboard and statistic on Blockchain Platform to enhance the efficiency of project management

SWHEPP Blockchain Platform

- After the launch of Blockchain Platform, a series of trainings and user feedback survey have been conducted which give:
  - ✓ Understanding more on the users needs about the hands-on features of Blockchain Platform and
  - ✓ Identifying areas for improvement, in particular for user interface design and performance issue.
- Aim for setting up a standard for developing a similar platform to DSD as a guideline in other DSD's projects in the near future.

https://www.dsdswhblockchain.com/


THANK YOU