

Combined LFG Utilization at Xiaping Landfill, Shenzhen, PRC



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Introduction of the Xiaping Landfill

- 1. Located in Qingshuihe, Luohu District, Shenzhen, Guangdong Province, PRC**
- 2. Design capacity: 50 million m³**
- 3. One of the largest landfills in China**
- 4. Open in 1997, design life ~ 30 years**
- 5. Expected closure in 2027 (or earlier)**
- 6. Valley fill, currently receiving 3,000 – 3,500 tpd of MSW**



The CDM Project

- 1. China (NDRC) / UK (Defra) Cooperation**
- 2. Project Developer: Lisai Development Co. Ltd.**
- 3. Credit Purchaser: Climate Change Capital**
- 4. One of the largest registered landfill CDM projects in China**
- 5. Total planned delivery > 2,500,000t CO₂ until end of 2012**
- 6. Average annual ER of ~ 470,000t CO₂**

CDM Project Development Status

2005.12: CER Purchase Agreement signed

2006.05: Approved by NDRC of China

2006.10: Approved by DEFRA of Britain

2007.05: Successfully registered at UNFCCC in May 2007

2007.07: Commencement of ER generation

2007.08: > 18,000t CO₂ ER generated

2007.12: Strategic expansion of gas collection system, engines and flares

Components of the LFG System

LFG Collection System

- Series of vertical extraction wells
- Above-ground HDPE pipes
- Condensate sumps, valves & monitoring ports
- Extraction (Roots) blowers



Components of the LFG System

LFG Flare

- **Enclosed type**
- **Existing capacity at 1,500 – 1,800m³/hr**
- **Planned expansion for another 3,000m³/hr in early 2008**



Components of the LFG System

LFG Engines

- **Current installed capacity at 3MW**
- **All electricity generated exported to grid**
- **Imported engines**
- **Both imported and local fuel pre-treatment systems**
- **2MW expansion in 2008**
- **Final capacity ~ 8MW**

Components of the LFG System

LFG Engines



Components of the LFG System

Compressed Purified Landfill Gas (CPLG) System

- Design capacity: 500m³/hr of raw LFG
- Product gas at 90%+ CH₄
- Operational in early 2007
- 3 gasoline vehicles converted



Challenges and Continual Improvements

Enhancing Communications

- **Need vested interests / common goals defined for all parties involved**
- **Regular meetings (talk more)**
- **Understand constraints of others, and build consensus**
- **Establish management hierarchy and line of communication / reporting**
- **Establish objective and achievable (realistic) goals to all parties**
- **Need continual support (no come-and-go)**

Improving Landfilling Practices

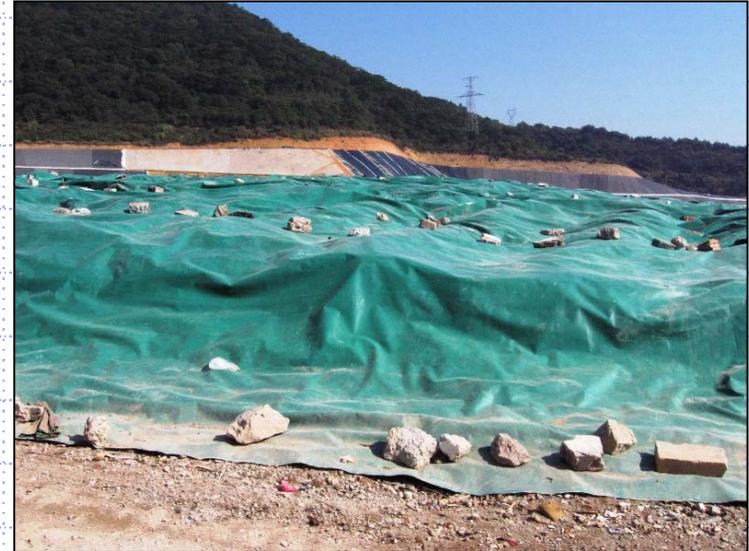
- × Working face too large (gas escape, odor)
 - × Insufficient cover (surface water problem)
 - × Compaction insufficient (loss of organics → ER)
 - × Too much C&D materials used as sub-base for access roads (loss of capacity, problems with well drilling)
-
- ✓ Soil / membrane cover
 - ✓ Landfill phasing

Improving Landfilling Practices

Before

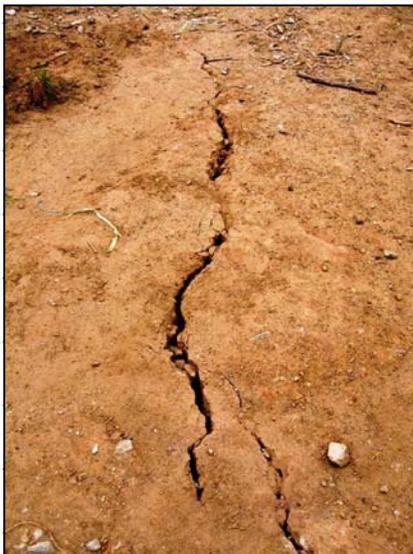


After



Improving Landfilling Practices

Before



After



Surface Water / Leachate Segregation

- × **Insufficient cover – surface water intrusion**
- × **Leachate underdrain not effective**
 - **Liquid level too high within landfill**
 - **Inhibit gas production**
- × **No temporary diversion / channels**

- ✓ **Temporary cover on landfill (liner / soil)**
- ✓ **Install leachate pumps**
- ✓ **Temporary channels**

Surface Water / Leachate Segregation

Before



After



Optimizing Existing LFG Collection System

- × **Collection efficiency too low:**
 - **Wellfield not optimized**
 - **Insufficient area coverage**
 - **Not enough wells**
 - **Wells are much shallower than design**
- × **Condensate blockages in header pipes**
- × **Leakages in pipes and joints**
- × **Monitoring instruments not calibrated**

Optimizing Existing LFG Collection System

- ✓ Survey on as-built locations, depth and liquid level
- ✓ Addition of strategic monitoring points
- ✓ Modify wellheads to suit operation purposes
- ✓ Calibrate instruments
- ✓ Establish monitoring / review programme
- ✓ Repair leaks / replace pipes
- ✓ Lay header to grade

Optimizing Existing LFG Collection System

Before



Optimizing Existing LFG Collection System

After



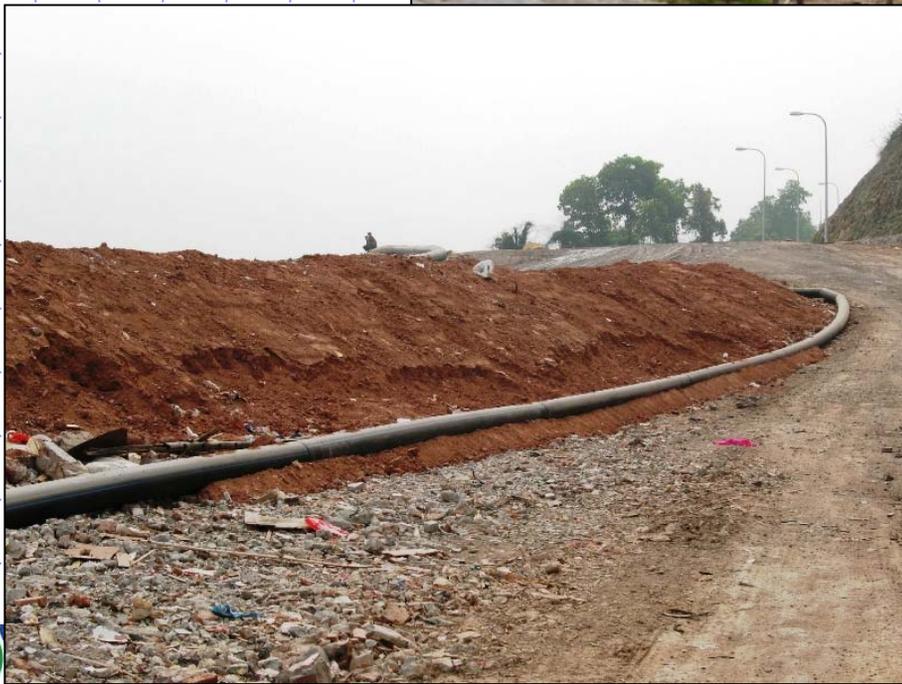
Optimizing Existing LFG Collection System

Before



Optimizing Existing LFG Collection System

After



Optimizing Existing LFG Collection System

Before

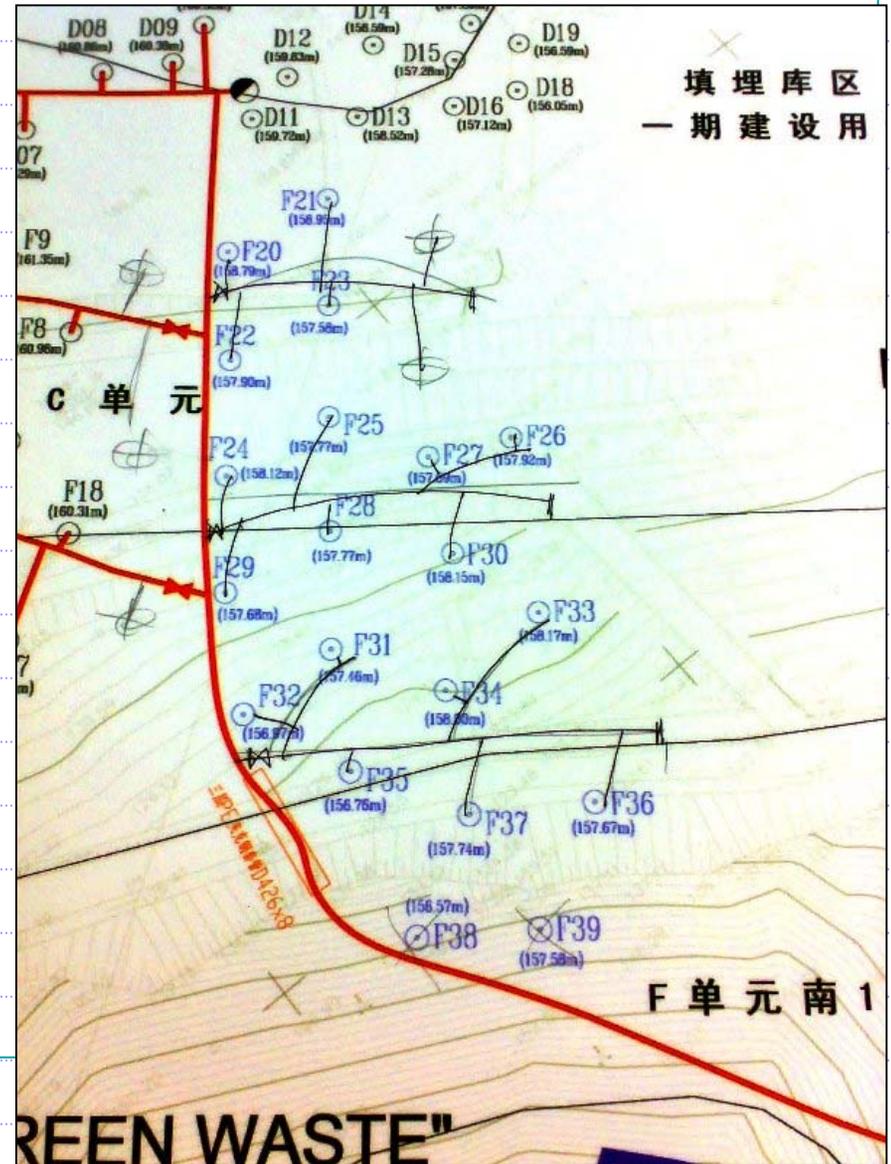
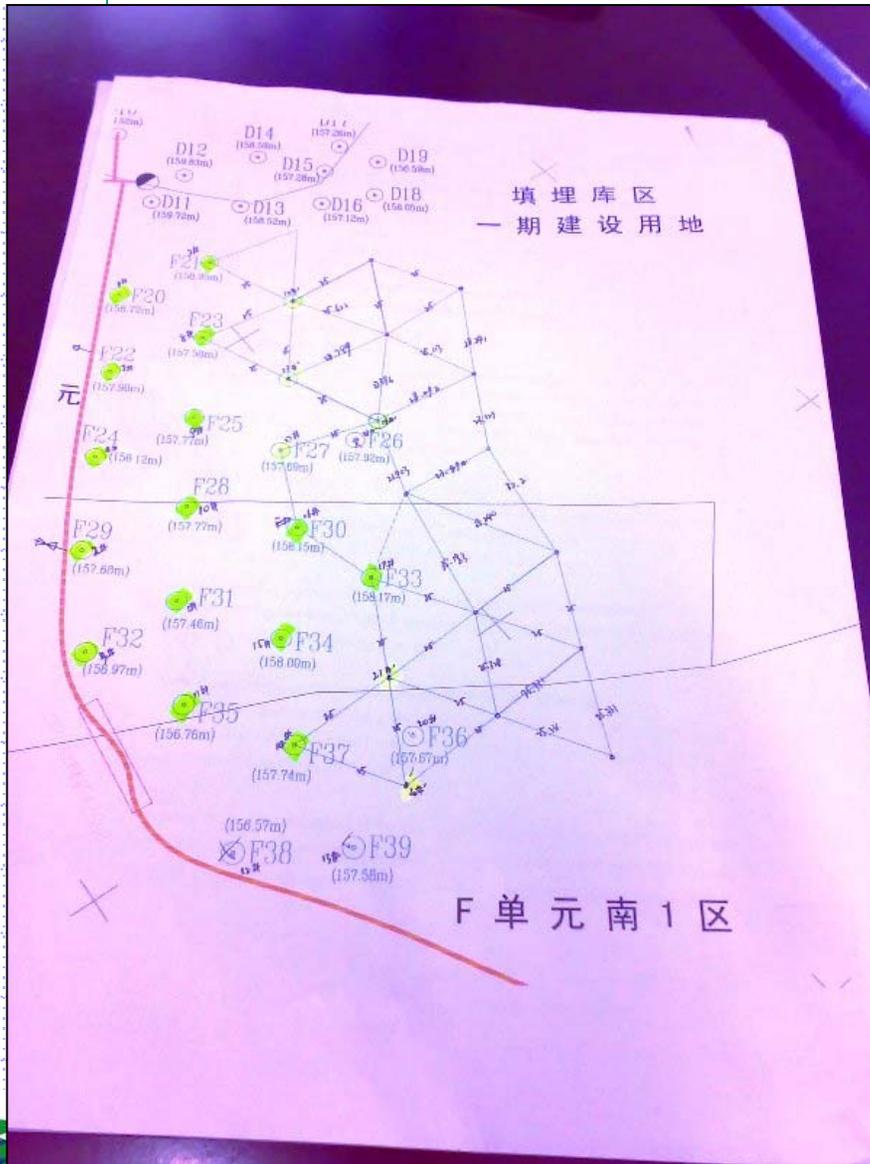
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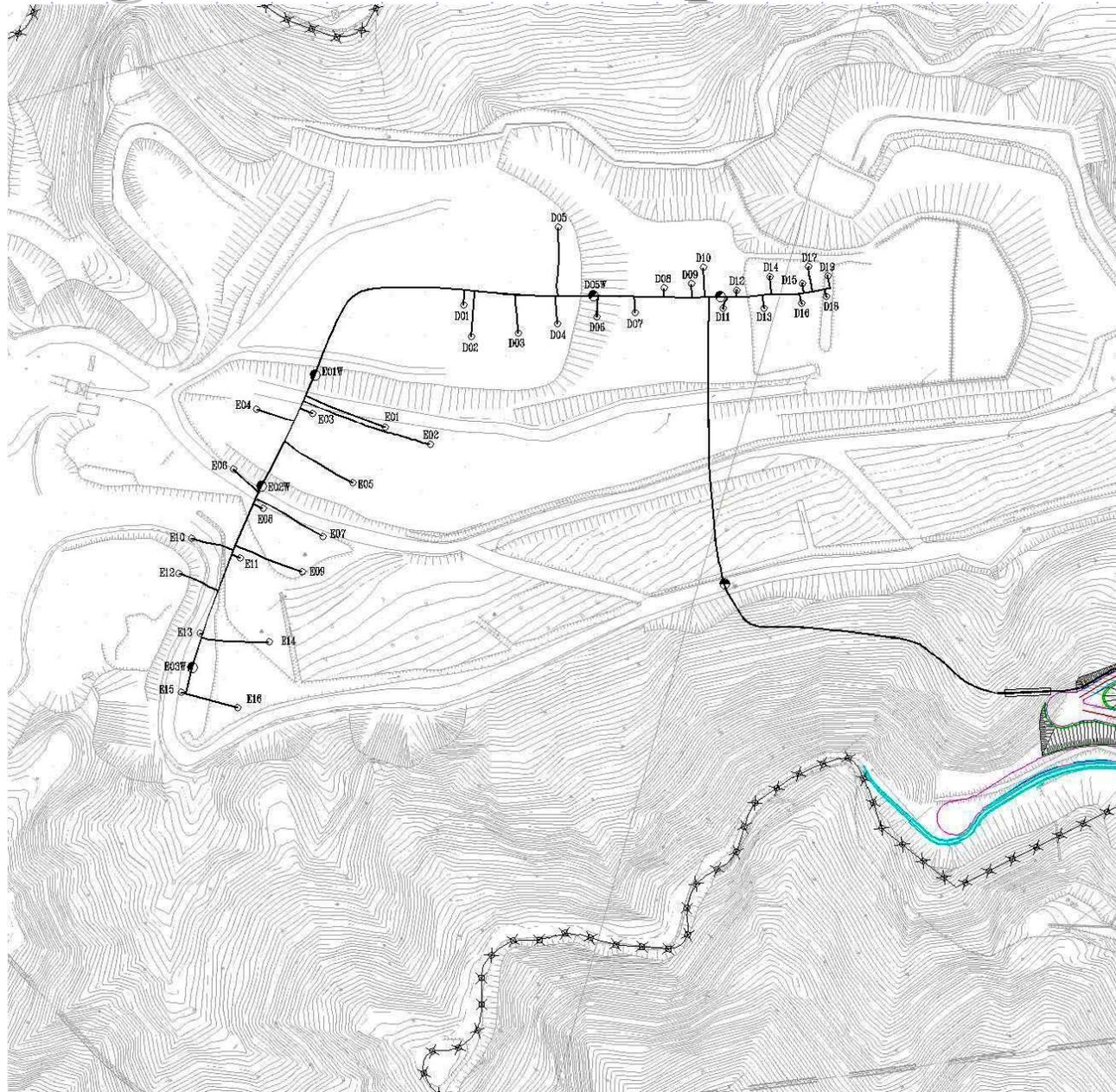
Strategic & Phased Expansion

- ✓ **Strategic expansion in gas collection system**
- ✓ **Proper design**
- ✓ **Construction QA/QC**

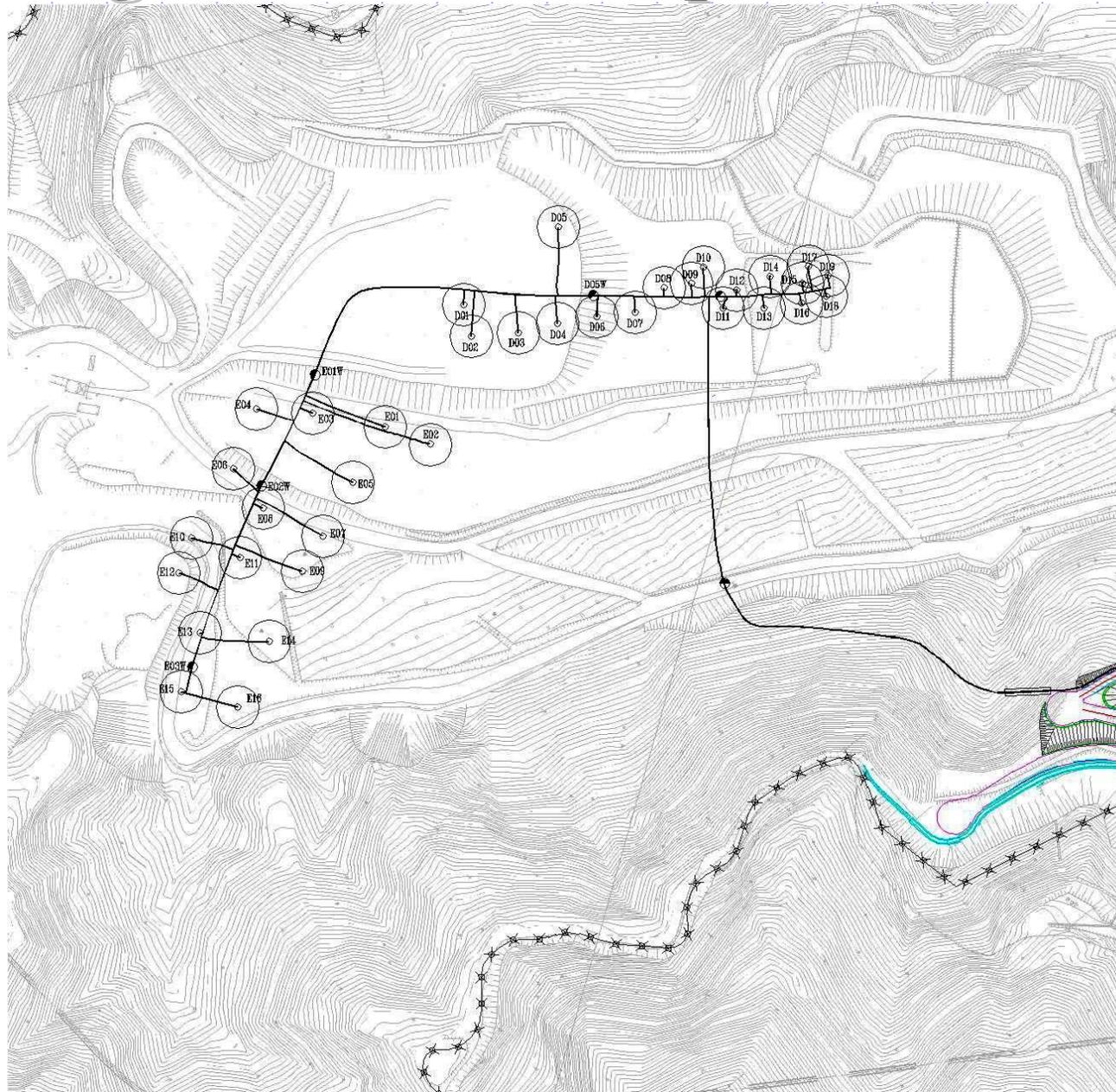
Strategic & Phased Expansion



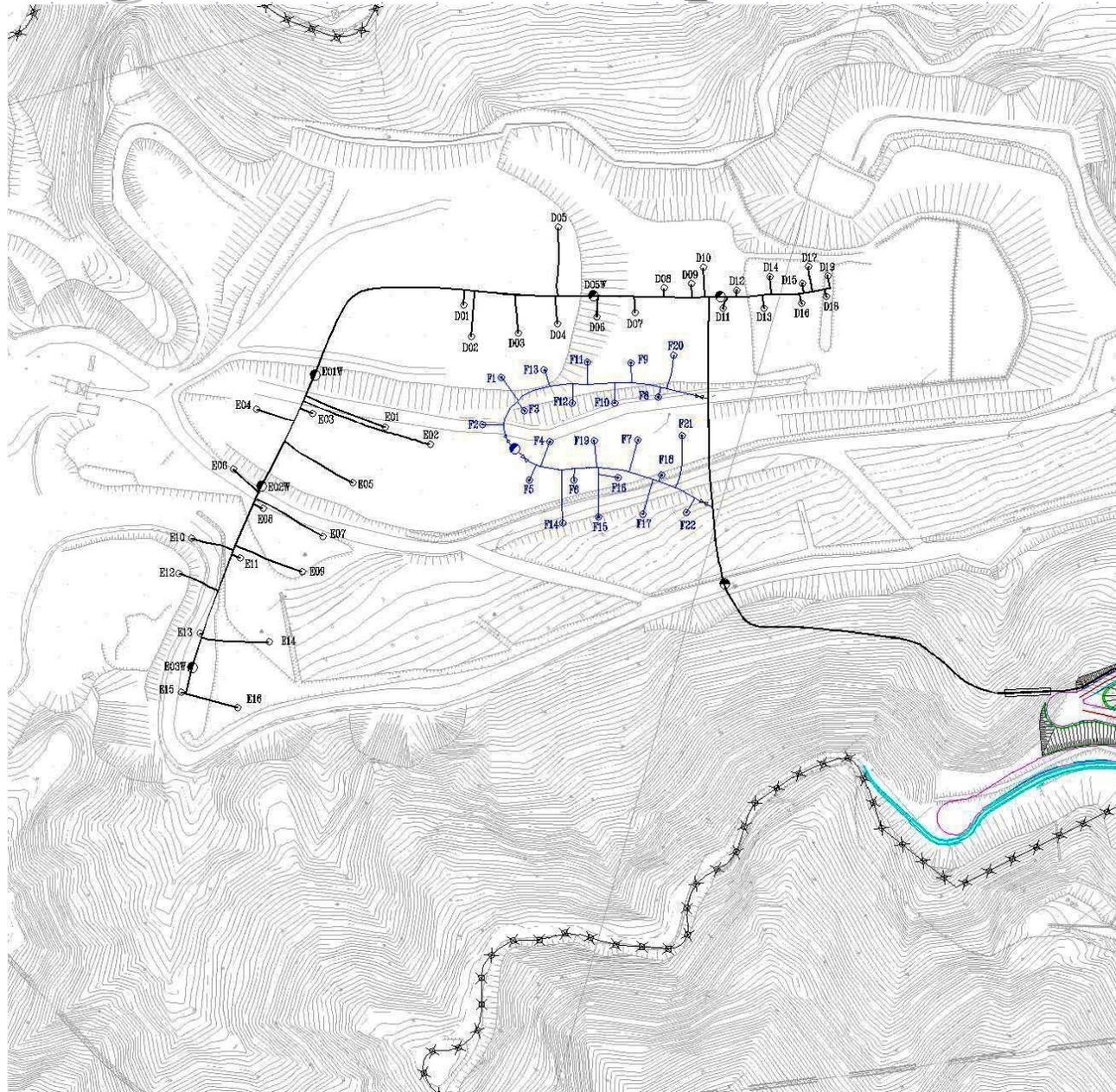
Strategic & Phased Expansion



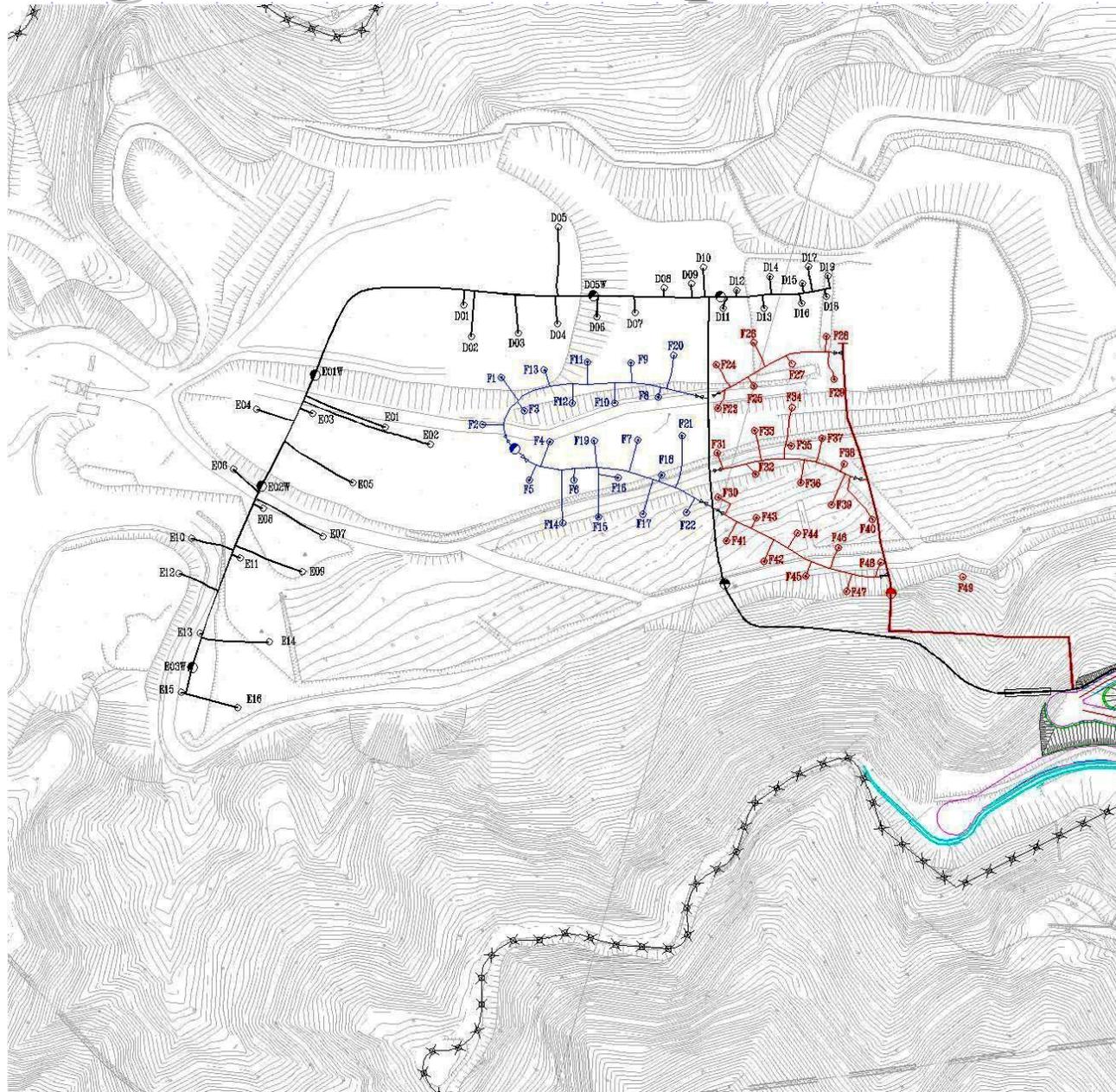
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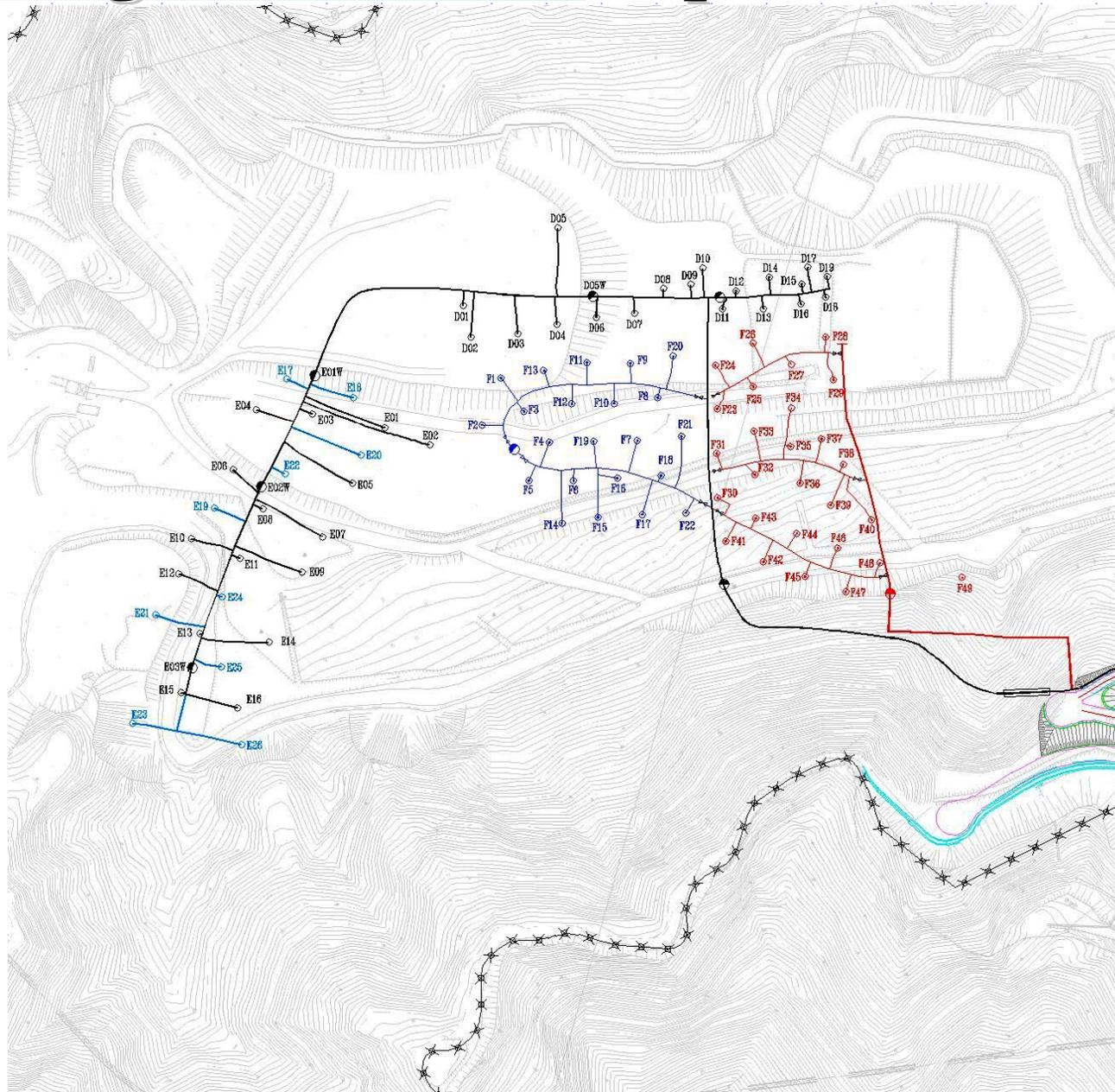
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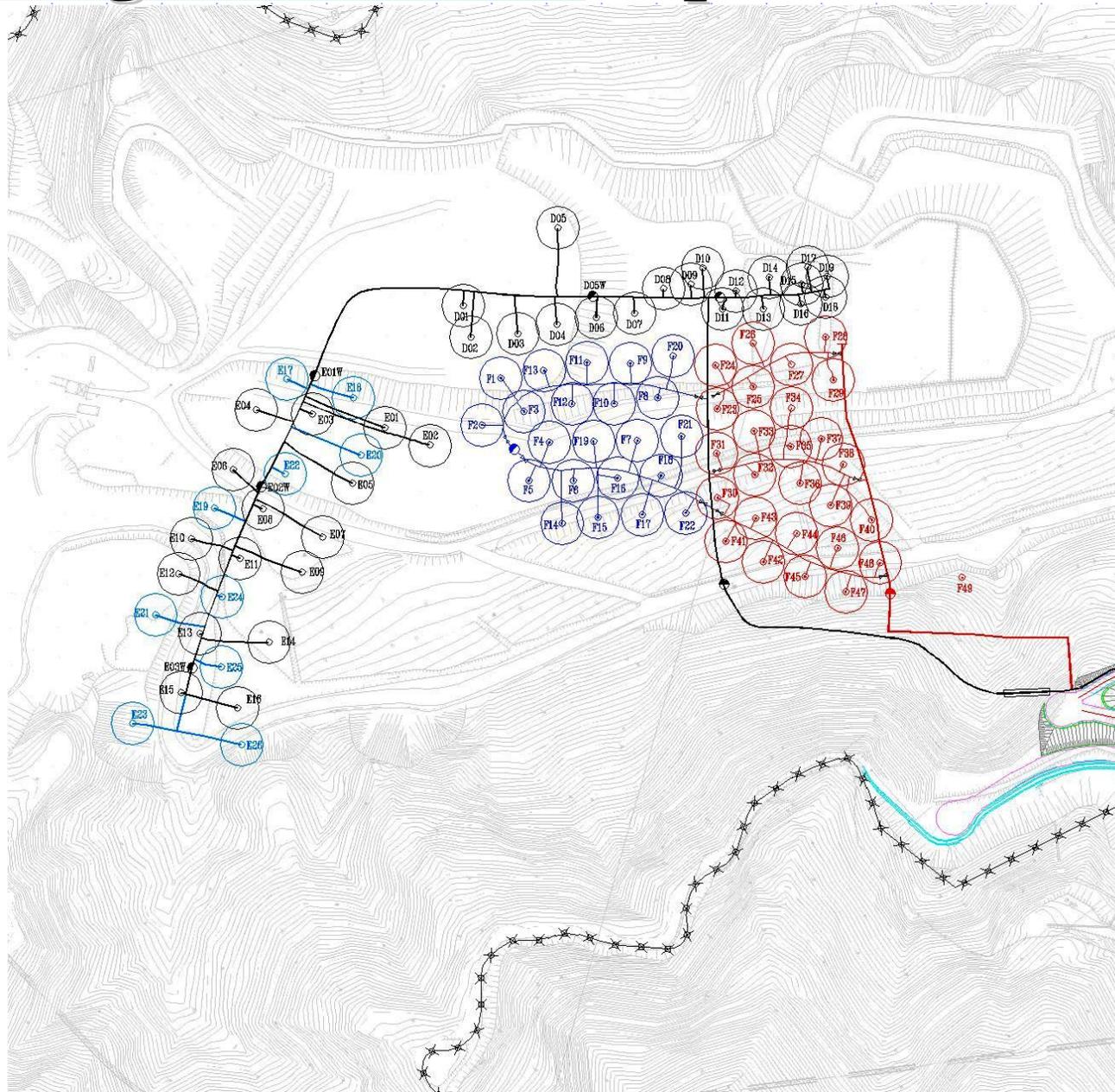
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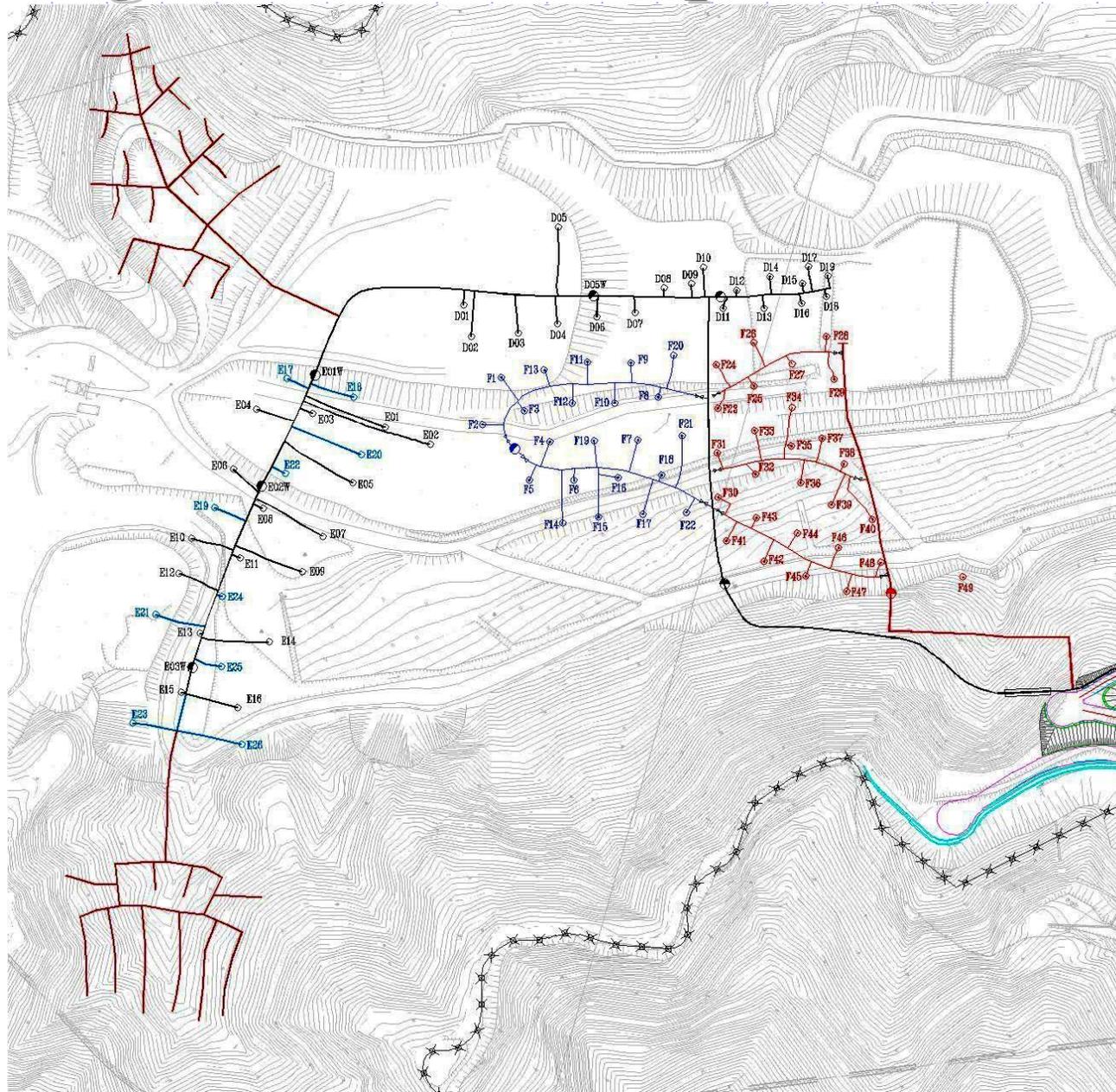
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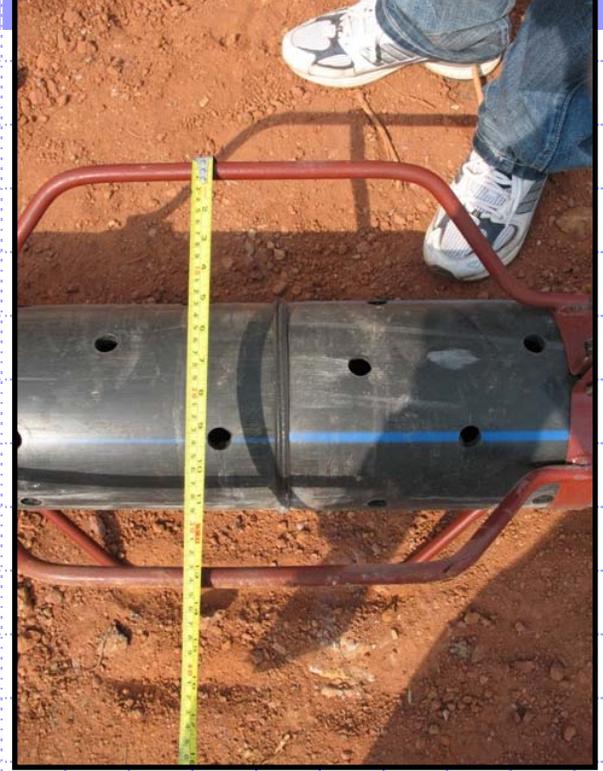
Strategic & Phased Expansion



Strategic & Phased Expansion



Construction QA/QC



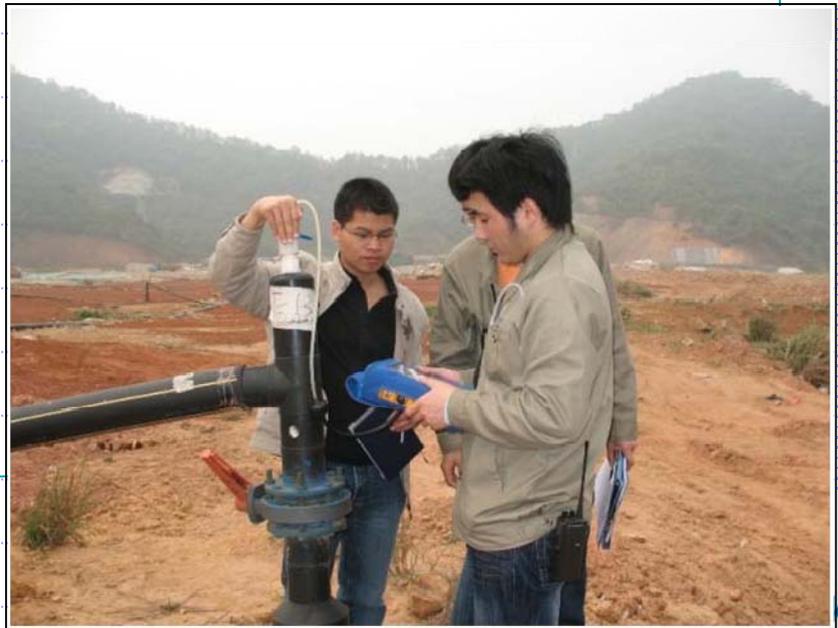
Capacity Building

- × **Lack of knowledge in engineers / technicians in operations**
- × **Record / review / audit system not in place**
- × **Instruments and data recording system not set up for CDM purpose**
 - **Improper selection / installation**
 - **Not certified / calibrated**
- × **Insufficient records and documentations to support DOE audits**

Capacity Building

- ✓ **Training**
- ✓ **Establish monitoring / review programme**
- ✓ **Replace / repair / calibrate / upgrade current CDM data recording and acquisition system**
- ✓ **Establish proper documentation & records**
- ✓ **Define duties and line of responsibilities**
- ✓ **Assign dedicated personnel in data collection, analysis / review, implementation and checking**

Classroom / Hands-On Training



Establish Monitoring / Review programme

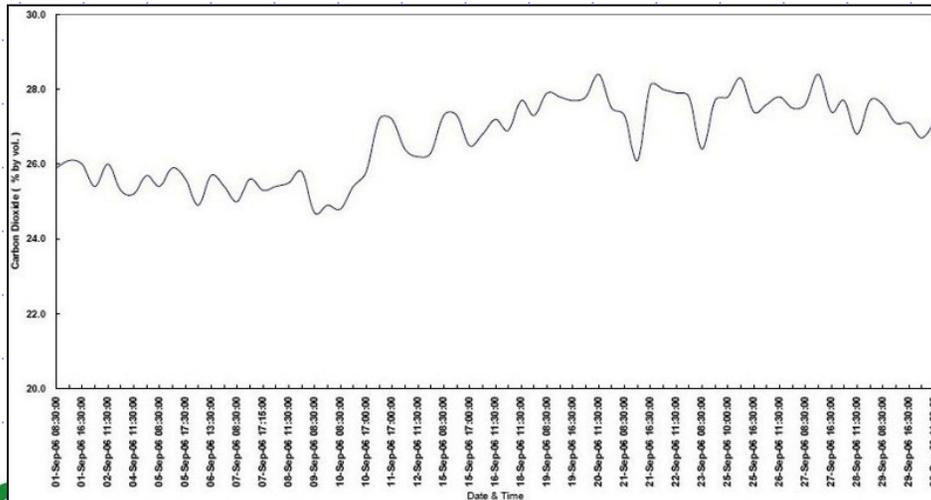
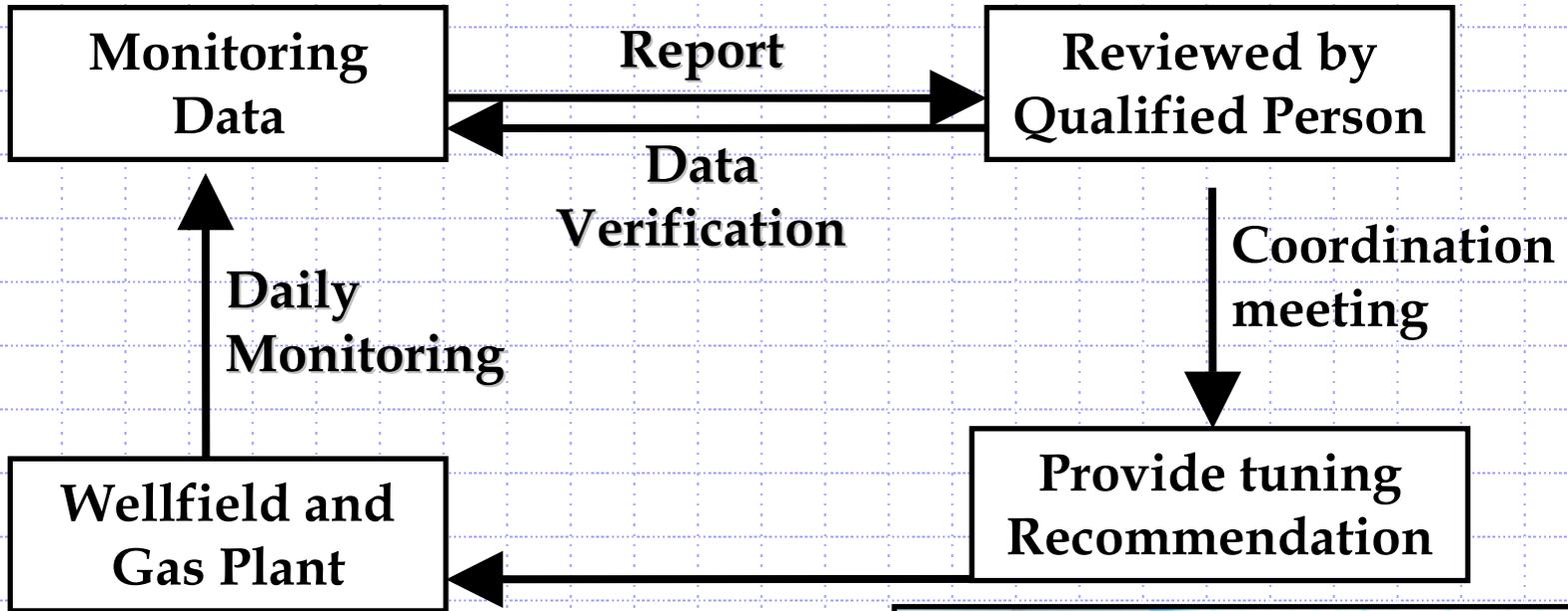
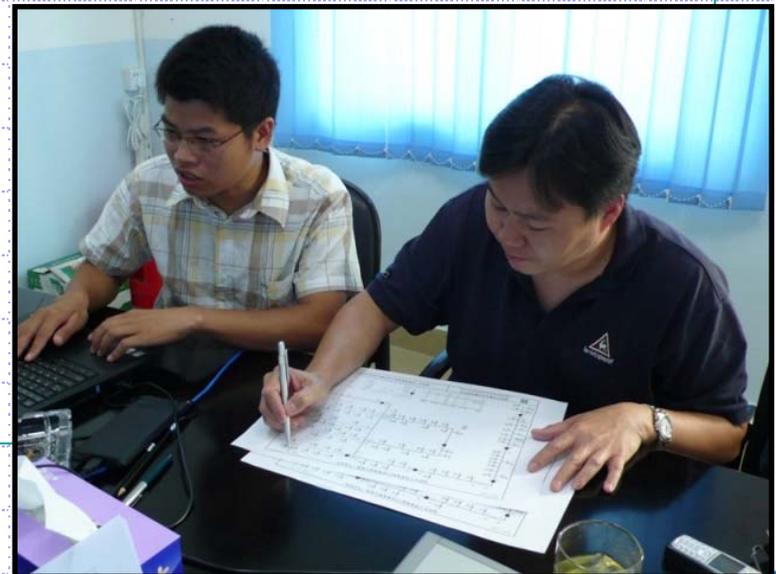
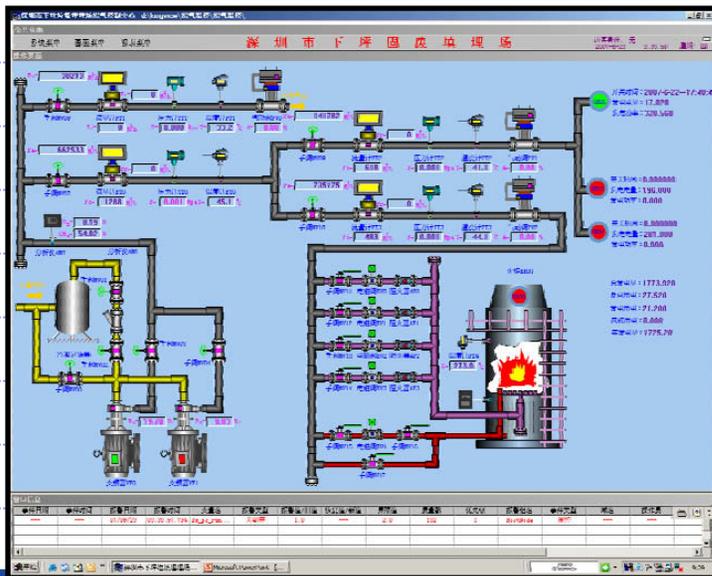
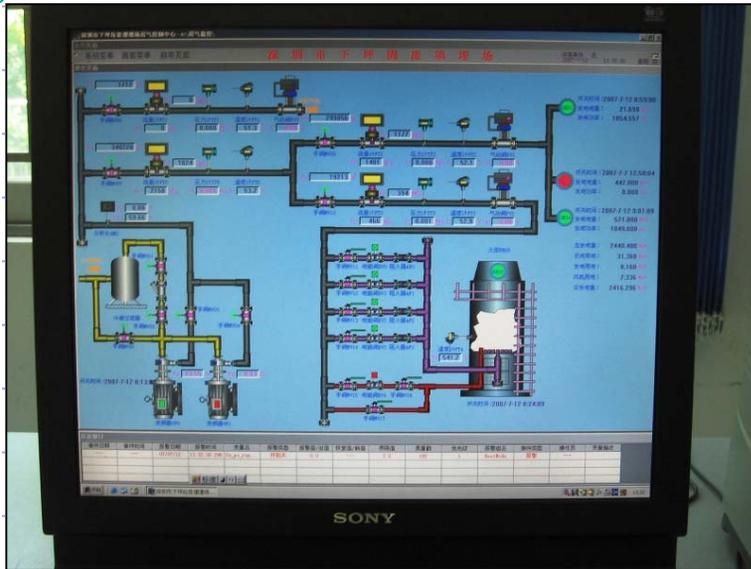


Fig. 4 - Carbon Dioxide (CO₂) content in September 2006



Data Acquisition System for CDM Purposes



Results

- ✓ **Existing Gas System Optimization and Strategic Expansion**
- ✓ **Area coverage ~ 30% → 60%**
- ✓ **2006: 35 gas wells, 700 – 800 m³/hr**
- ✓ **Now: 94 gas wells, 2,500 – 3,000m³/hr**
- ✓ **Additional ER income ~ Euro 4,000 / day !!**
- ✓ **More vertical wells and horizontal collectors under planning**

Looking Ahead ...

- ✓ **More vertical wells and horizontal collectors under planning**
- ✓ **Gas recovery:**
 - ~ 4,000m³/hr (early 2008)
 - ~ 6,000m³/hr (2012)
- ✓ **More flares and engines**
- ✓ **Phase 2 landfill expansion under planning**

THANK YOU !!

For more information, please contact

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