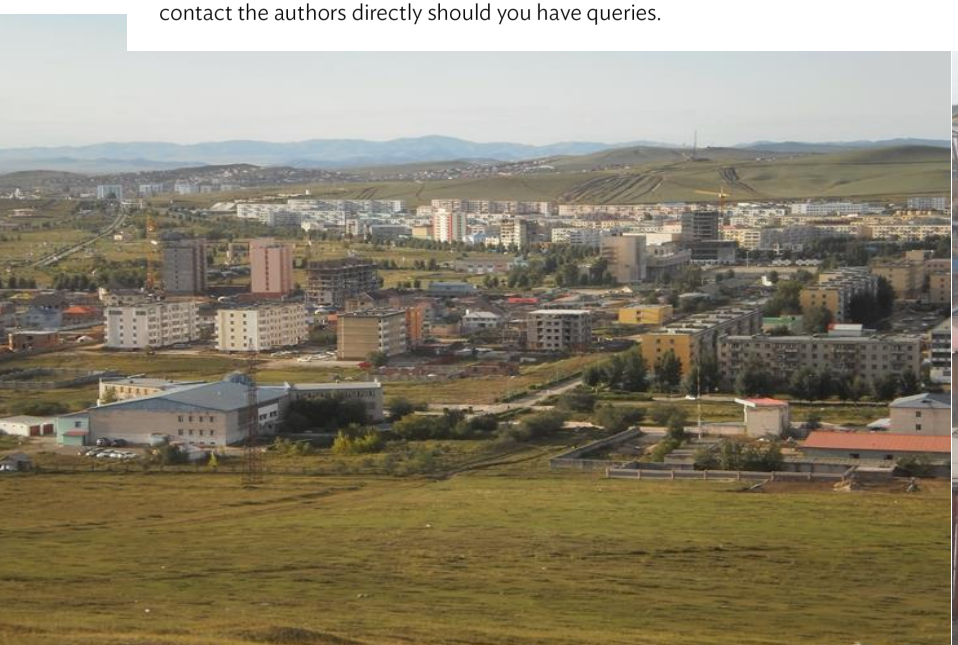
A Mongolian Challenge: Water Supply and Sanitation in Cold Climate, Low Density & Low Income Places

A successful ADB – CDIA cooperation in Darkhan

Presentation to ADB's Urban Community of Practice
27 November 2014



Proposed ADB Loan:
MON Darkhan Wastewater Management Project

- **Preparation without PPTA funding, including overall WWM strategy for Darkhan reflecting urban pattern, densities, topography, climate, affordability and identify key infrastructure needs for ADB financing**
- **Provide technical assistance and financing support to structurally rehabilitate and fully retrofit the existing WWTP with a new technology that is suitable for cold climates to be procured as plant: design, supply and install package (DBOA)**
- **Provide design and financing support for the key wastewater collection infrastructure investment needs: 2 pump stations and key sewer main replacements**
- **Project Management support**
- **Coordinate with CDIA Pre-Feasibility Study outputs for inclusion of key components to be funded through loan i.e. water supply and sewer extensions into Ger areas, sanitation in Ger areas (later excluded by Government)**

CDIA Prefeasibility Study: Darkhan WSSIIP Project Purpose and Objectives

PFS as package of good quality (technically, economically and financially feasible) infrastructure investment programs and projects. Attract investment in Water Supply and Sanitation Infrastructure from Government, Development Partners, and the Private Sector.

- **Purpose:** Assist City of Darkhan to determine best options for delivering safe and affordable drinking water supply and sanitation - particularly in ger areas.
- **Objective 1:** Review lessons learned from water supply and sanitation projects in ger areas from German financed “MoMo” project in Darkhan and from other domestic and international initiatives in Mongolia.
- **Objective 2:** Prepare sector investment plan and prefeasibility study identifying priority urban water supply and wastewater management improvement infrastructure for Darkhan as a model for Mongolia.
- **Objective 3:** Develop a model for low-cost, semi-decentralized water supply and sanitation systems for ger areas

Darkhan: Mongolia's third largest City

- **Mongolia's second city: resident population 80,000; 100,000 including floating population**
- **Located on Trans-Siberian Railway and road link (ADB supported)**
- **Mongolia's Premier Industrial City outside Ulaanbaatar**

Mongolia's Contrasting Inra-urban Disparities

Centrally-planned Areas

- Planned grid-system layout
- Predominantly owner-occupied apartment dwellings
- Water supply: household connections from reticulated system
- Sanitation: centralized sewerage system and wastewater treatment
- Heating: centralized district heating system
- Electricity: networked supply
- Social infrastructure: well provided
- High to medium income & commercial

Ger Areas

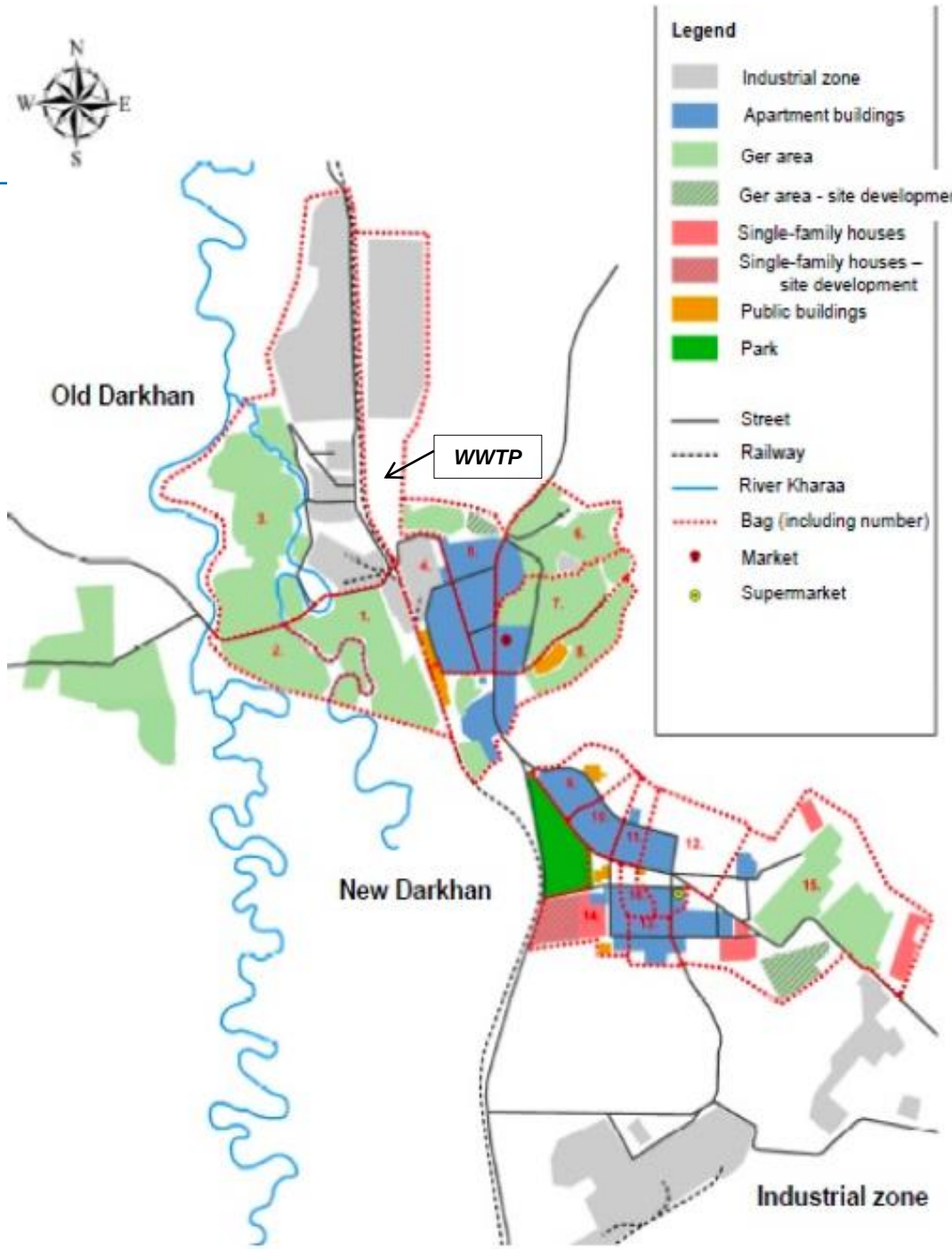
- Unplanned or semi-planned layout
- Housing: detached dwellings or gers on large (700 + sqm) occupier-owned plots
- Water Supply: kiosks (served by tankers, water mains or wells)
- Sanitation: pit latrines
- Heating: by coal-fired stoves
- Electricity: networked supply
- Social infrastructure: poor service
- Medium to low income residential; some used as secondary home

Darkhan City Layout

- No current Masterplan (under preparation)

- **Blue:** Serviced apartment areas
- **Green:** Ger areas
- **Grey:** Industrial areas
- **Pink:** Existing and planned for serviced townhouse development

- Moderate Growth (3% per annum in recent years)
- Almost 50% of population live in Ger ares



Challenges and Opportunities of WASH

- **Overall:**
  - Max ambient temp approx. 30 deg C; min approx. -40 deg C. (All pipes > 3.5 m below surface or heated: very high costs)
- **Centrally Planned Areas:**
  - 100 % coverage from existing water supply and sewerage systems – but overdesigned and in poor state of repair (NRW approx. 50%) significant sewer leakages
  - Water supply wells capable of delivering 60,000 cum per day, current demand < 10,000 cum per day.
  - WWTP designed for 50,000 cum per day, current average flow rate < 10,000 cum per day, in poor state of repair.
- **Ger Areas:**
  - No networked services except power
  - Strong demand for services
  - Limited ability to pay
  - Some on areas difficult and expensive to engineer (high water table, soil heave) and vulnerable to flooding

Darkhan WWTP: Oversized & Poor State of Repair

Darkhan WWTP: Dilapidated Biological Reactors

Darkhan WWTP: Redundant Sedimentation Unit

Condition of Water and Wastewater Infrastructure

Primary Sewage Pumping Station

Water Main

Ger Area Water Supply Kiosk

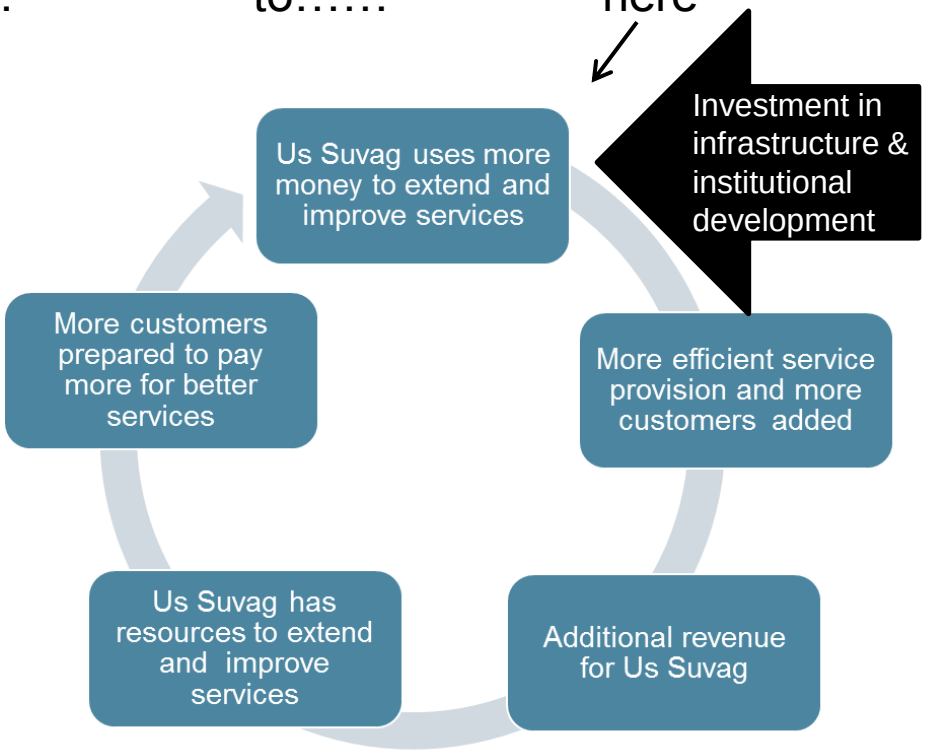
Water Delivery to Water Kiosk by Truck

Service Delivery Institution and System Sustainability

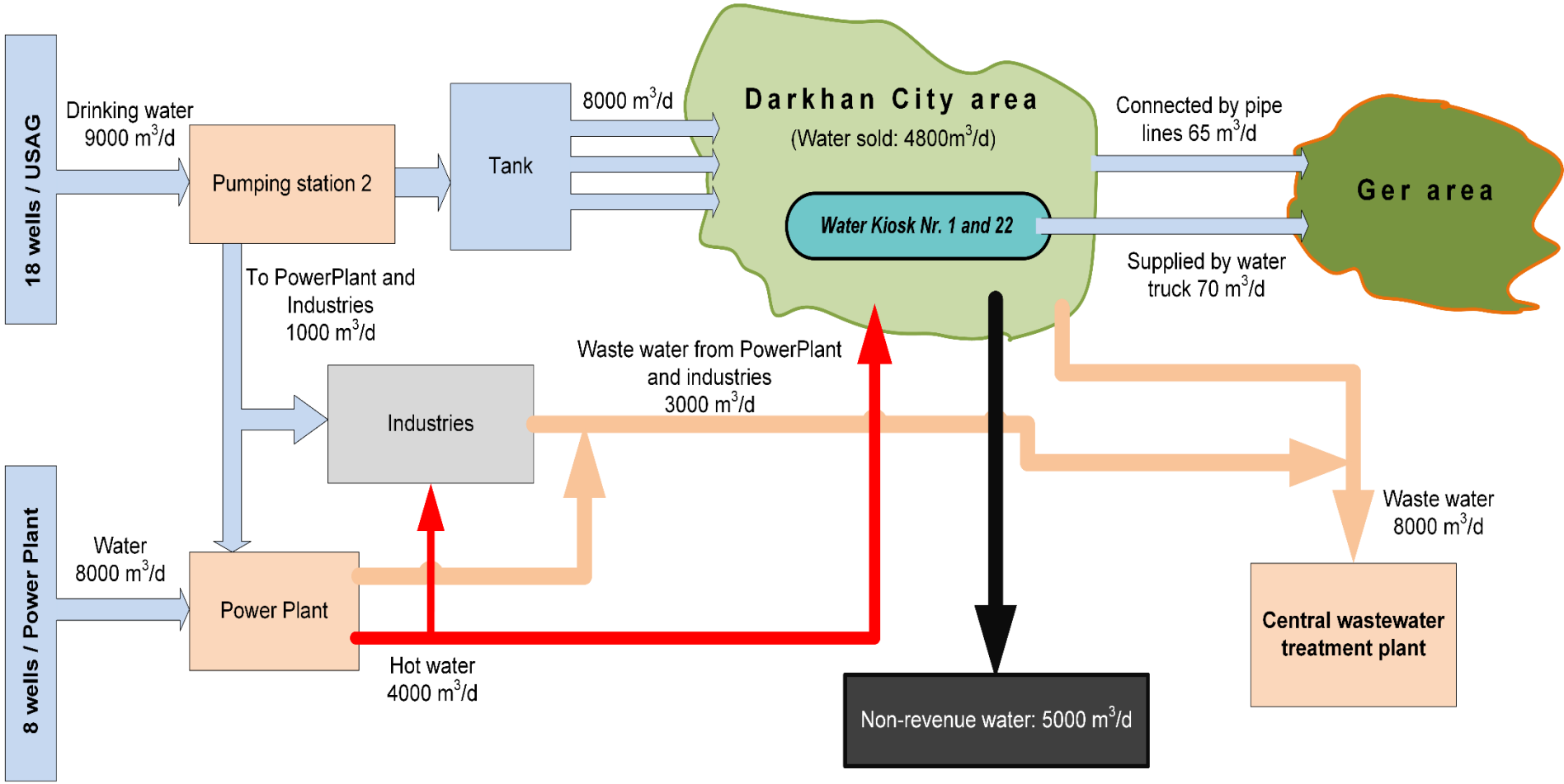
Assets owned and operated by water supply and sewerage company (Us Suvag) – survives on revenues from consumers (>95% from serviced areas – about 45% of service population) plus subsidy from Aimag Govt.

Engineering-driven institution: very limited customer focus.

Challenge: getting from here….. to…… here



Darkhan – Approximate Water Balance



Lessons from Prior Interventions in Ger Areas

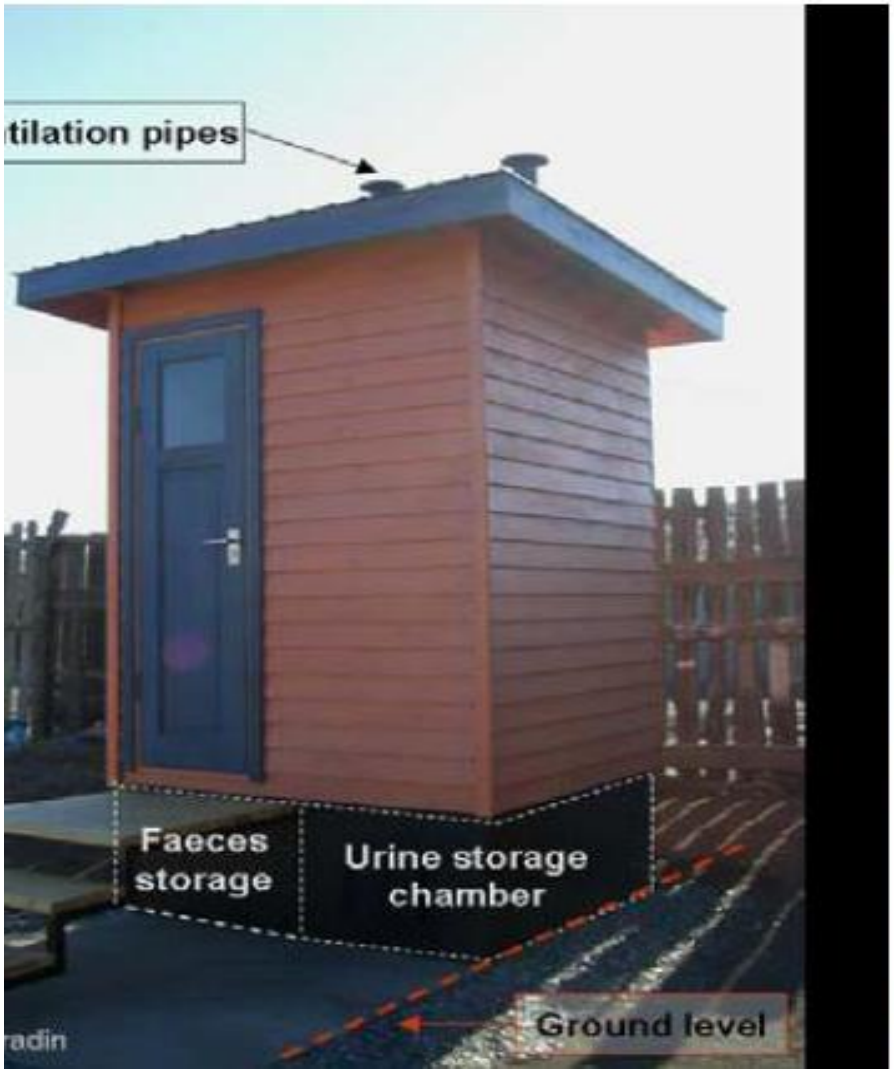
- Numerous prior attempts to improve ger area water supply and sanitation in urban ger areas, Including those supported by: Govt; WB; ADB; UN; JICA; GIZ; ADF etc.
- Many failures:
  - Ger households slow to connect to centralised networks due to high costs of connection and heating buildings and service lines in winter;
  - Networked services hard to maintain in working order unless flow rates are high (public buildings & commercial units rare in ger areas);
  - Benefit for water supply connections to water kiosks to maximise opportunities for households, or groups of households to connect;
  - Sewer systems and decentralised WWTPs too expensive and difficult to maintain (WB and “softline” technology pilot failures)
  - On-plot sanitation solutions (such as the Ecosan toilet) can be successful but require considerable technical input and community involvement and support to assure system sustainability.
  - Collective community effort hard to achieve in Mongolia

Application of learning to WSSIIP in Ger Areas

- Align investments with likely city development, growth and affordability trajectory: should be incremental in nature;
- Adopt technologies which provide the most cost-effective solution based on physical, social and affordability characteristics while capable of enhancement;
- Adopt only technical solutions with a strong and realistic indication of success – avoid pilot approaches;
- Excreta removal systems can work, but attention required for excreta removal & disposal service arrangements;
- Pipe freezing is a particular problem, caused by low water consumption, low water and wastewater flows and pipe heating cable disconnections or failures; value in involving beneficiaries in taking some responsibility to avoid freezing.

Approaches piloted under MoMo Project

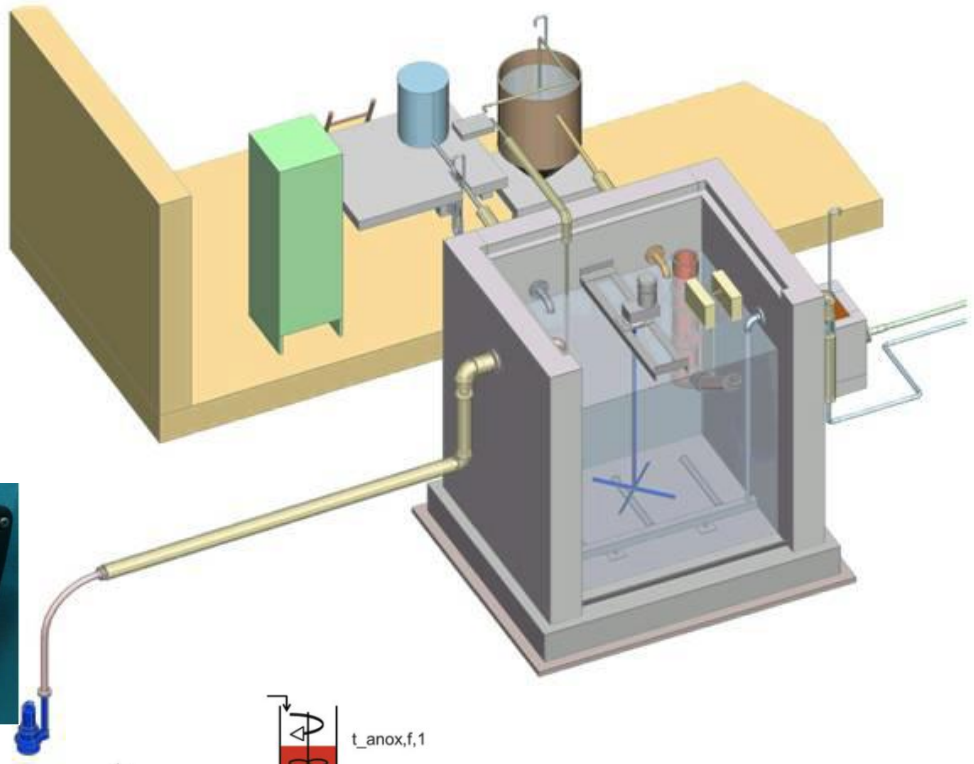
- Eco-san type Excreta Removal Toilet



Approaches piloted under MoMo Project

- “Eco-san”-type Excreta Removal Toilet

Approaches piloted under MoMo Project: SBR Pilot at Darkhan WWTP



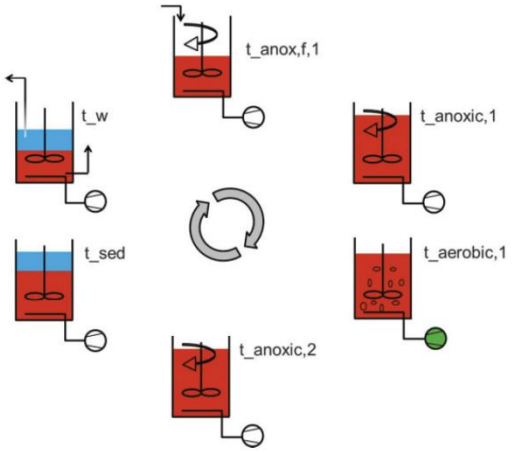


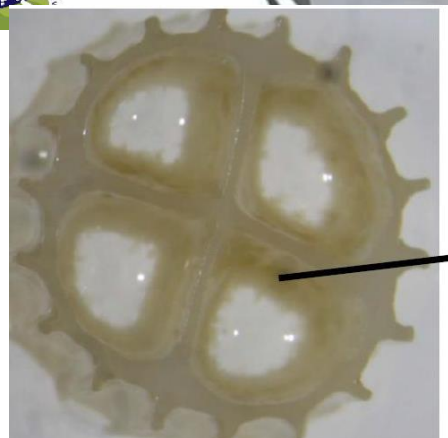
Figure 2: Illustration of one complete SBR treatment cycle consisting of different

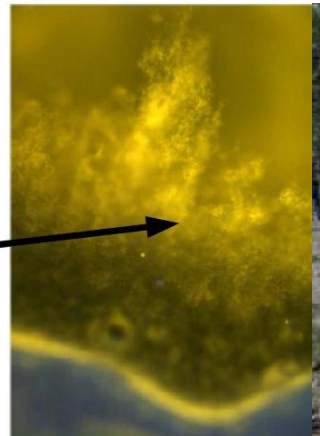
Government Pilot: Flexible, Heated Sewer Pipes

- Government supporting use of softline technology (heated pipes to reduce pipe depth)
- Operational problems: freezing at interconnections to housing; high operational costs

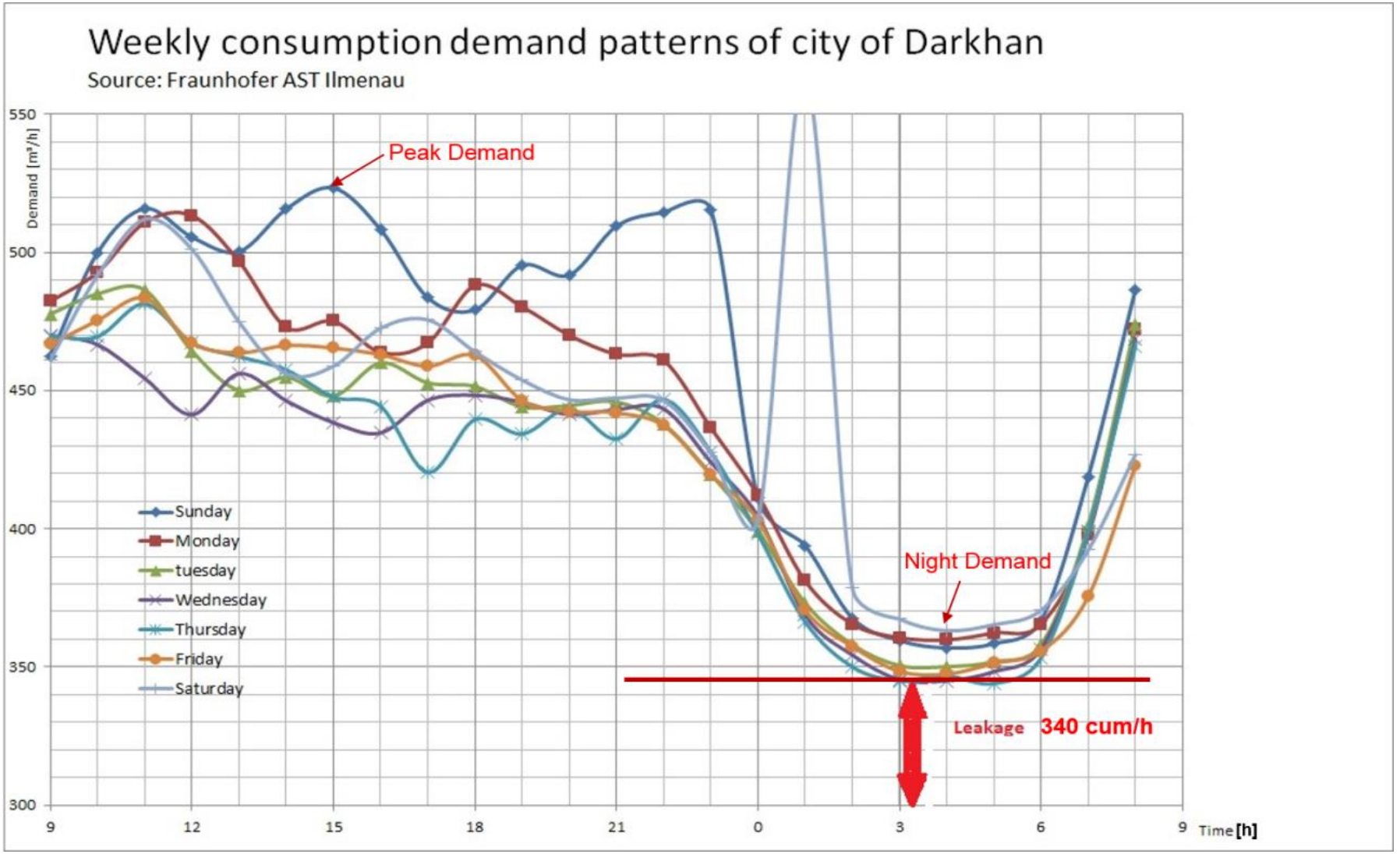
Lessons from MoMo: Pilot for Decentralized WWTP

1. Primary clarifier - Sedimentation of coarse particles and sludge
2. Biofilm reactor - The highly efficient biofim reliably removes pollutants
3. Final clarifier – The treated water runs off i.e. to join a creek or a infiltration





Example of System Data from MoMo Project



Darkhan Water and Wastewater Sector Strategy

Strategic Goals Developed in Consultation with Stakeholders:

1. Universal and equitable household access to potable water supply and hygienic sanitation facilities;
2. Sustainable potable water supply and wastewater service provision;
3. Improved protection of the environment.

These strategic goals are expressed in specific measurable targets

Investment Phase Strategic Targets: Physical & Environmental

STRATEGIC TARGETS

Target Dates	Current	2020	2025	2030
Physical				
H/H with water connection	**55%**	65%	73%	84%
Ger H/H with water connections	**0%**	16%	40%	76%
H/H with sewerage connections	**55%**	65%	73%	84%
Ger H/H with sewerage connections	**0%**	16%	40%	76%
% water kiosks served by network	**38%**	90%	100%	100%
Premises with individual meters	**91%**	100%	100%	100%
Premises with smart meters	**0%**	1%	50%	100%
Environmental				
Non-Revenue Water %	**50%**	40%	32%	25%
Ger H/H rating sanitation fair or good	**17%**	40%	60%	80%
% WWTP effluent samples > standard	**80%**	95%	99%	99%

Investment Phase Strategic Targets: Financial and Institutional

STRATEGIC TARGETS

Financial	**Current**	**2020**	**2025**	**2030**
% Collection Efficiency	**74.0%**	94%	97%	99%
Accounts Receivable, in no. of days	**69**	45	37	30
Operating Ratio	**120%**	95	80	70
Return on Revenue	**-31%**	10%	20%	30%
Institutional				
Staff per 1,000 connections	**17**	15	12	10
Ger-area Connections Unit	**None**	Established		
Network complaints received per month	20	12	8	5
Connection complaints received per month	400	300	200	150

Darkhan Water and Wastewater Sector Strategy: Investment Plan

1. In three Phases: Immediate action program (2015 to 2020); Medium-term Program (2021 to 2025); Long-term Program (2026-2030)
2. Elements of the Program:
   A. Core area water supply and wastewater management improvements
   B. Expansion area services
   C. Ger area improvements
   D. Supporting Institutional Strengthening and Reform
   E. Supporting Financial Management Improvements

Investment Plan for Core and Expansion Areas

	Phase I (2015-2020)	Phase II (2021-2025)	Phase III (2026-2030)
Drinking water supply	Water extraction (Monitoring system / MoMo)	Simulation of ground water resources for master planning	Remote monitoring of wells and control of groundwater pumps
	Rehabilitation of 27km pipe lines (Reducing of leakages from 48% to 35 % / cooperation with MoMo)	Rehabilitation of 30km pipe lines (Reducing of leakages from 35% to 25 % / cooperation with MoMo)	Rehabilitation of 30km pipe lines (Reducing of leakages from 25% to 15 % / cooperation with MoMo)
	Rehabilitation of 17 Basement		
	Remote controlled monitoring of 4000 water meters	Remote controlled monitoring of 4000 water meters	Remote controlled monitoring of 3277 water meters
Waste water treatment and sewer network	Rehabilitation of 6.2km existing sewer pipe lines	Rehabilitation of 20km existing sewer pipe lines	Rehabilitation of 20km existing sewer pipe lines
	Rehabilitation of the existing 9 booster pumps in 3 stations	Monitoring of operation of 3 pumping systems	Remote control of operation of 3 pumping systems
	Structural rehabilitation and retro-fitting of waste water treatment plant	Optimization of operation and maintenance of central waste water treatment plant	Optimized daily operation process of central waste water treatment plant
Extension	Extension of 11,1km water pipe, 11,4km sewer pipe and 3000 remote controlled water meter for new apartment and business houses in northern of new Darkhan	Extension of 10,2 km water supply and sewer network for oil refinery, 17,2 km water supply and sewer network for new districts 3000 remote controlled water meters	Extension of water supply (15km), sewer network (15km) and 8000 remote controlled water meter
Base Cost	47,829 Million MNT	20,057 Million MNT	22,401 Million MNT

Investment Plan for 11,000 Ger Area Households

	Phase I (2015-2020)	Phase II (2021-2025)	Phase III (2026-2030)
STRATEGIC TARGETS	9164 households supplied by water kiosks connected to network (83%)	7020 households supplied by water kiosks connected to network (63%)	3672 households supplied by water kiosks connected to network (33%)
	1,609 household connection (15%)	3,890 household connection (35%)	6,622 household connection (76%)
Water consumption	Other potable sources And deep wells (2%)	Other potable sources And deep wells (2%)	Other potable sources and deep wells (1%)
	1,140m3/d	2,540m3/d	4,170m3/d
Pipeline expansion	Water supply: 46km Sewerage: 19km	Water supply: 33km Sewerage: 27km	Water supply: 40km Sewerage: 37km
Base Cost -system Base Cost – h/h con	21.2 billion MNT 9.0 billion MNT	16.5 billion MNT 12.0 billion MNT	24.3 billion MNT 21.5 billion MNT

Wastewater Project Goals, Outcomes and Outputs

- **Project Goals:**
  - Make a significant and measurable contribution to improving the urban environment of Darkhan city
  - Improve the water quality of the Kharaa River to meet international standards
- **Project Outcomes:**
  - improved management and treatment of both industrial and domestic wastewaters delivered through more efficient and effective technology, processes and procedures
- **Project Outputs:**
  - A new and more efficient central wastewater treatment plant
  - Rehabilitation and equipment replacement at pump stations, and replacement of critical sections of the sewer network
  - Enhanced water & wastewater management institution & project management and operational skills developed in Us Suvag staff.

ADB Funding of Priorities of Investment Program

From the Investment Program, Government requests ADB funding support for:

- WWTP, pumping station, and critical sewer main improvement;
- Institutional strengthening; and
- Improved Financial Management.

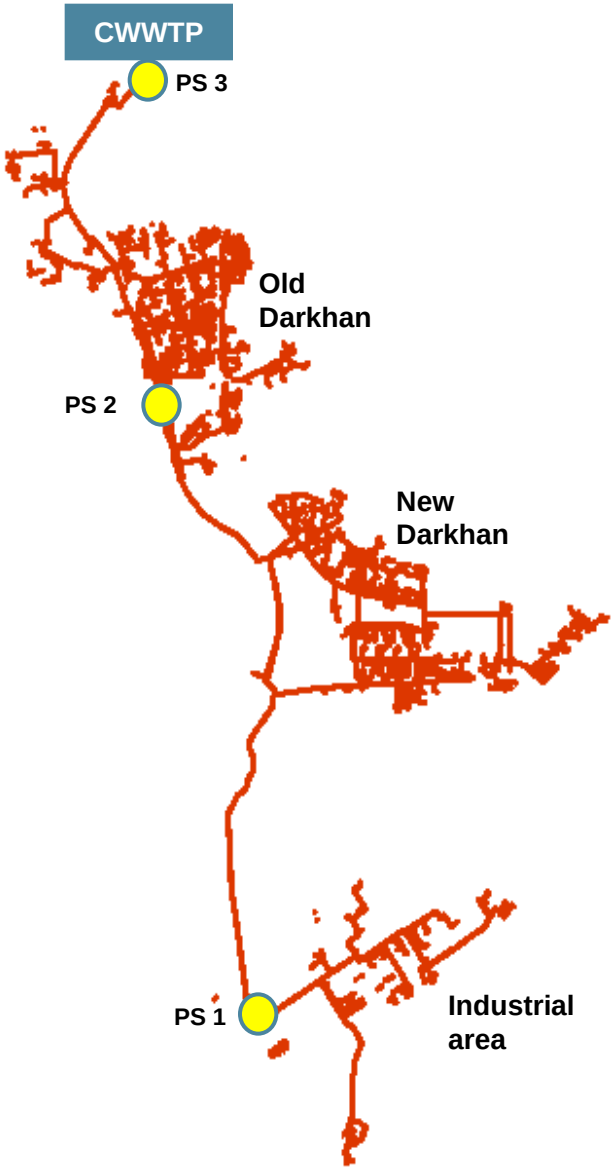
Government initially considered including priority ger area water supply and sanitation improvements identified under CDIA PFS in loan: subsequently decided to fund from own resources.

Institutional and financial management support leading to and more efficient operation, enhanced cost recovery and an enhanced consumer base critical to generating better prospects for additional funding sources (including potential for private sector investment)

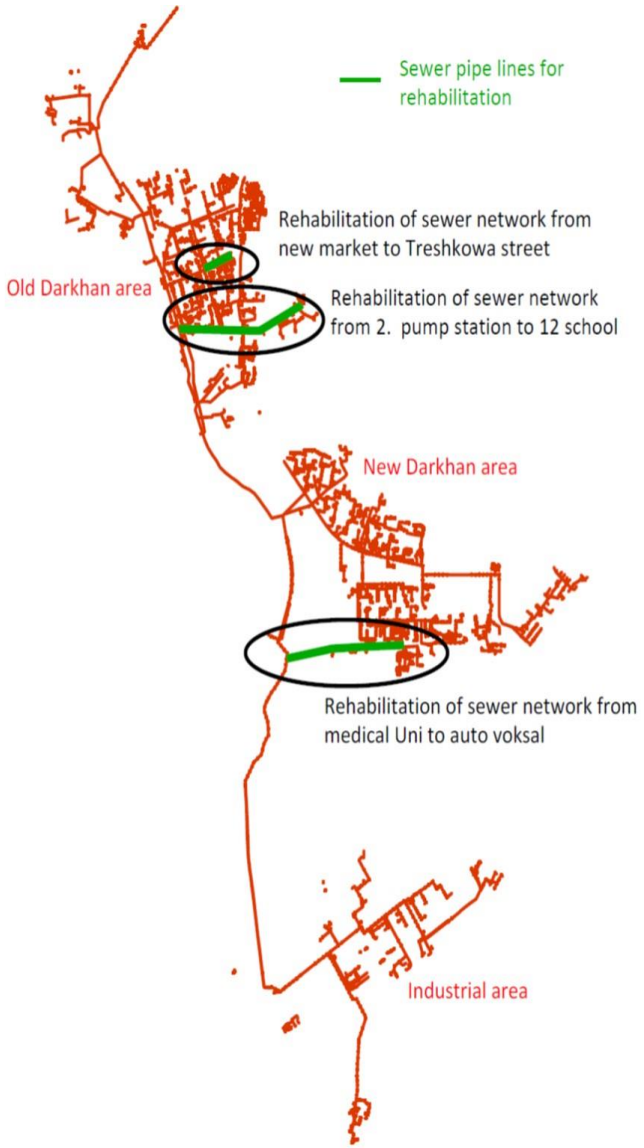
ADB Proposed Loan Project Components

- **Part A1:** Construction of a new wastewater treatment plant as an Integrated Fixed-film Activated Sludge Plant using some structures of the existing plant: including tertiary effluent treatment, and sludge treatment and disposal systems
- **Part A2:** Rehabilitation of the primary and secondary sewage pumping stations and replacement of critical sections of sewer.
- **Part B:** Institutional Reform and Capacity Development of Darkhan Us Suvag to improve structure, effectiveness and performance of Us Suvag, including improved industrial wastewater managment.
- **Part C:** Project Management Support to MCUD, Darkhan-Uul aimag and Us Suvag to manage project execution and implementation and quality assure the treatment plant design, tender, construction and commissioning

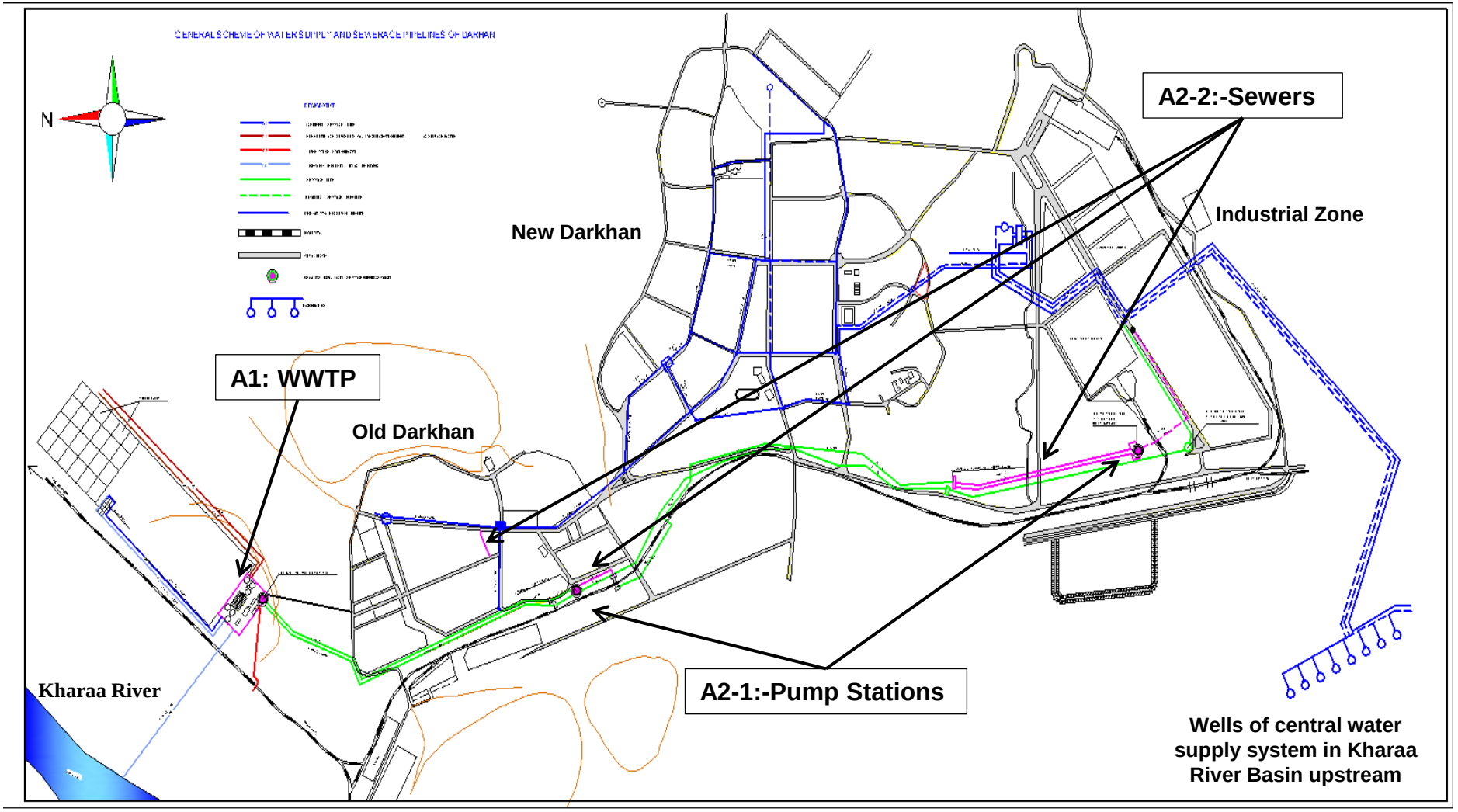
Wastewater Pumping System and Treatment Plant Rehabiliation 2015-2020(ADB Loan Financing)



6.2км New Sewer Mains 2015-2020 (ADB Loan Financing)



Wastewater Management Improvements for Darkhan



Evaluation of Wastewater Treatment Options

- Initial scan of all possible treatment options – led to shortlisting of four (including rehabilitation using structurally sound elements of existing plant and new plants)
- These four subject to detailed comparative evaluation including:
  - Experience of technology in Mongolia
  - International experience of technology in similar climates and environments
  - Operational and treatment characteristics
  - Lifetime costs
- Recommendation of Integrated Fixed-film Activated Sludge (IFAS) using existing structural elements further evaluated and eventually ratified by:
  - Standing Technical Committee for Wastewater at MCUD
  - Specialist committee created for the purpose

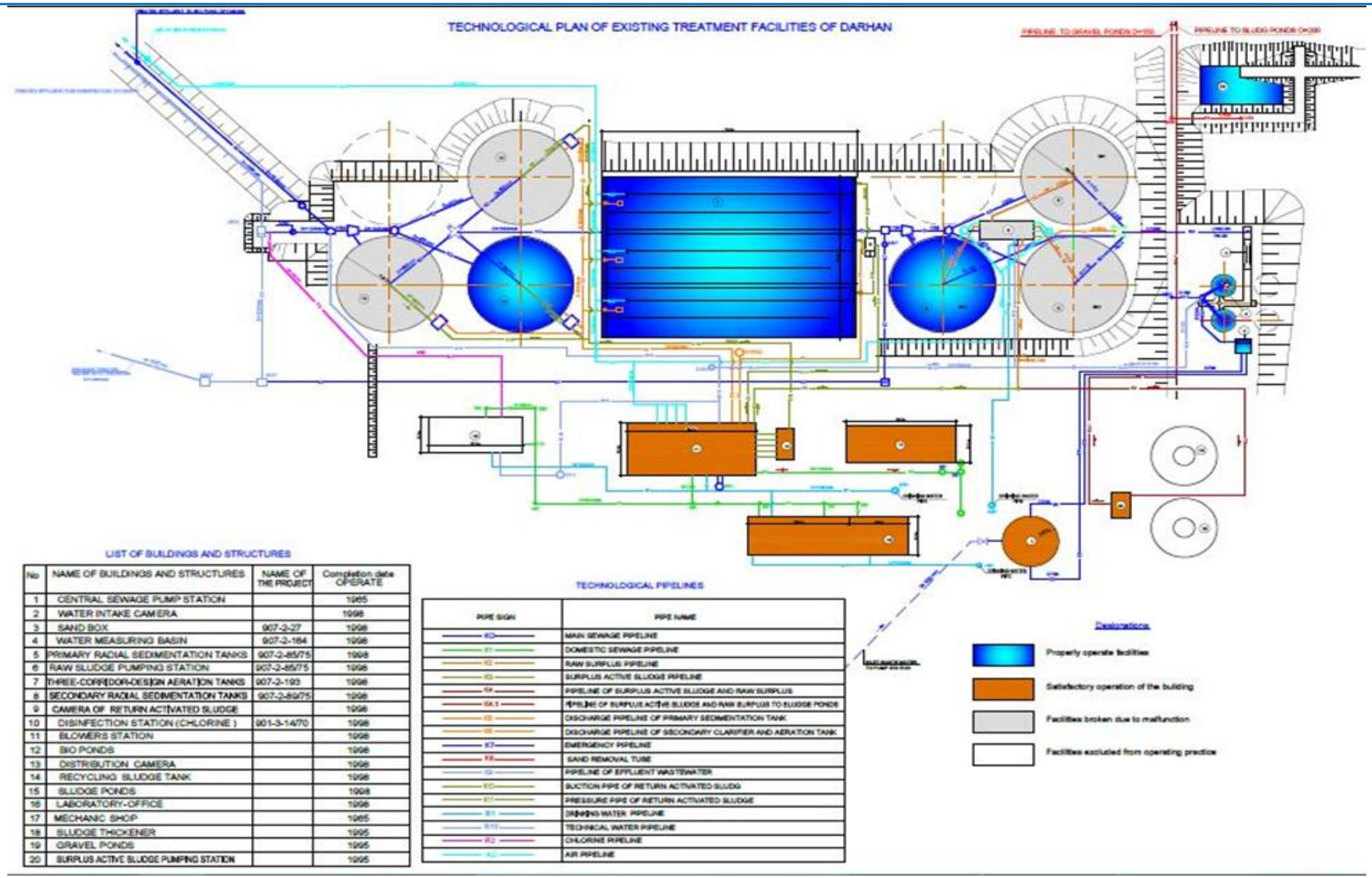
Lessons from WWTP technologies in cold climates

- Avoid low loading rates and high retention times (freezing risk)
- Adopt flexible and robust systems to accommodate changing biomass characteristics

In the evaluation of step feed activated sludge, SBR and IFAS systems:

- The step-feed activated sludge process is slightly more expensive and has slightly higher operational cost than the other two systems.
- Sequencing batch reactor technology offers high treatment efficiency and potentially the lowest operational costs, but demands high-levels of operational control, and is currently only used in small private plants in Mongolia, and nowhere in climates similar to that of Darkhan.
- IFAS commonly used elsewhere under similar climatic conditions, including in Russia and China.

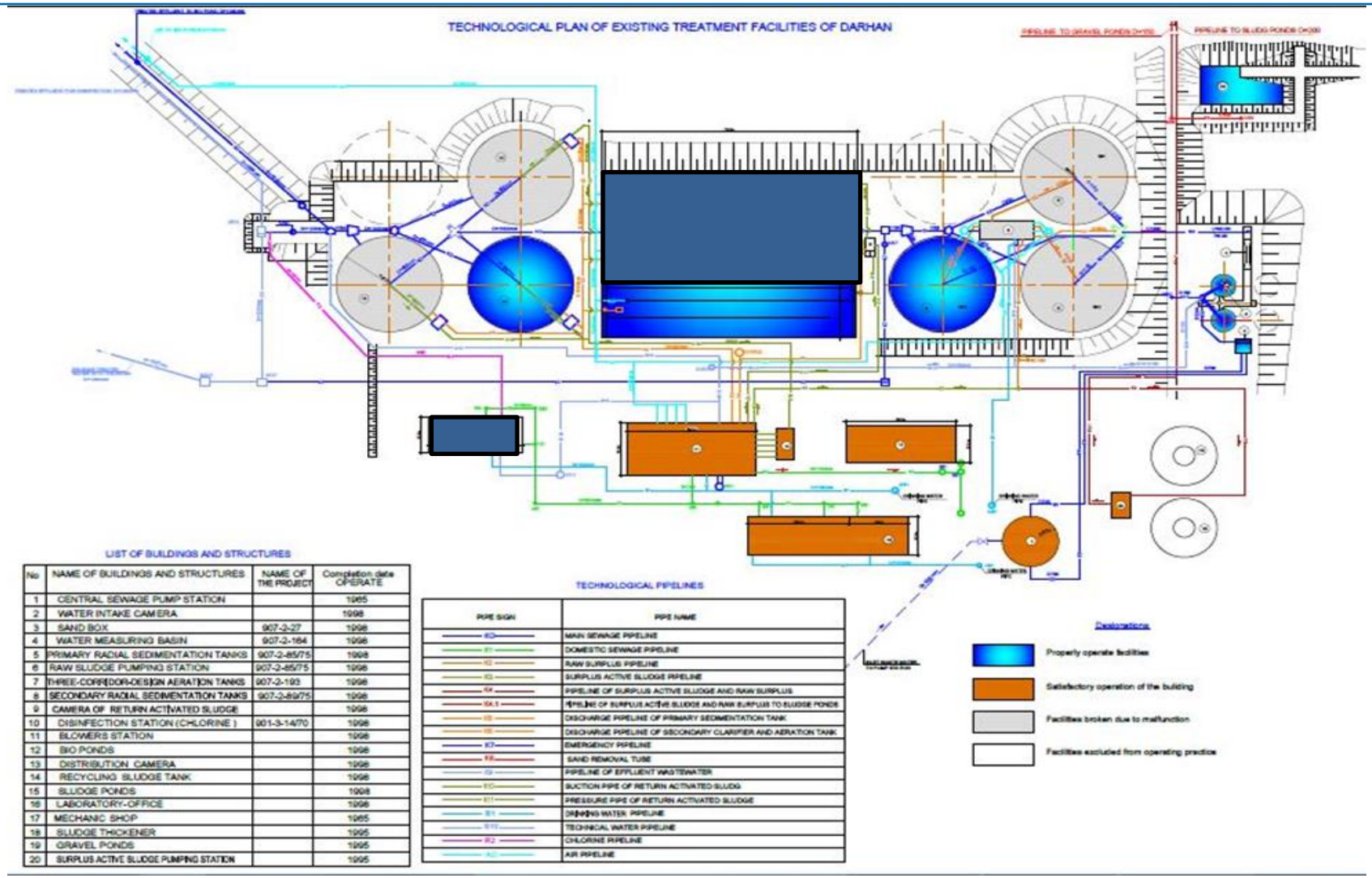
Existing Activated Sludge Process Treatment Plant



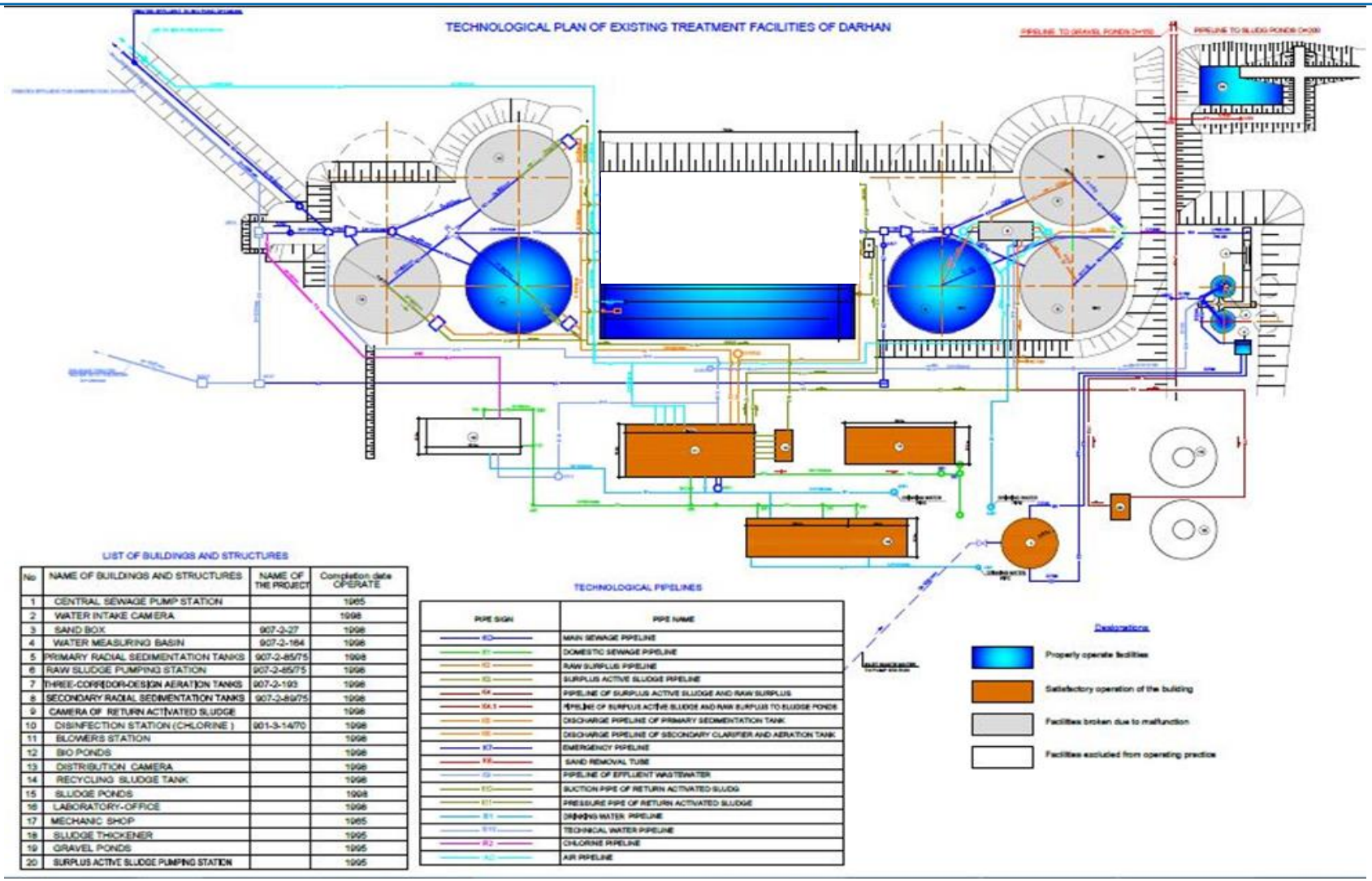
No	NAME OF BUILDINGS AND STRUCTURES	NAME OF THE PROJECT	Completion date OPERATE
1	CENTRAL SEWAGE PUMP STATION		1965
2	WATER INTAKE CAMERA		1998
3	SAND BOX	907-2-27	1998
4	WATER MEASURING BASIN	907-2-164	1998
5	PRIMARY RADIAL SEDIMENTATION TANKS	907-2-85/75	1998
6	RAW SLUDGE PUMPING STATION	907-2-85/75	1998
7	THREE-CORRIDOR-DESIGN AERATION TANKS	907-2-193	1998
8	SECONDARY RADIAL SEDIMENTATION TANKS	907-2-89/75	1998
9	CAMERA OF RETURN ACTIVATED SLUDGE		1998
10	DISINFECTION STATION (CHLORINE)	901-3-14/70	1998
11	BLOWERS STATION		1998
12	BIO PONDS		1998
13	DISTRIBUTION CAMERA		1998
14	RECYCLING SLUDGE TANK		1998
15	SLUDGE PONDS		1998
16	LABORATORY-OFFICE		1998
17	MECHANIC SHOP		1965
18	SLUDGE THICKENER		1995
19	GRAVEL PONDS		1995
20	SURPLUS ACTIVE SLUDGE PUMPING STATION		1995

PIPE SIGN	PIPE NAME
K0	MAIN SEWAGE PIPELINE
K1	DOMESTIC SEWAGE PIPELINE
K2	RAW SURPLUS PIPELINE
K3	SURPLUS ACTIVE SLUDGE PIPELINE
K4	PIPELINE OF SURPLUS ACTIVE SLUDGE AND RAW SURPLUS
K4.1	PIPELINE OF SURPLUS ACTIVE SLUDGE AND RAW SURPLUS TO SLUDGE PONDS
K5	DISCHARGE PIPELINE OF PRIMARY SEDIMENTATION TANK
K6	DISCHARGE PIPELINE OF SECONDARY CLARIFIER AND AERATION TANK
K7	EMERGENCY PIPELINE
K8	SAND REMOVAL TUBE
K9	PIPELINE OF EFFLUENT WASTEWATER
K10	SUCTION PIPE OF RETURN ACTIVATED SLUDGE
K11	PRESSURE PIPE OF RETURN ACTIVATED SLUDGE
K12	DRINKING WATER PIPELINE
K13	TECHNICAL WATER PIPELINE
K14	CHLORINE PIPELINE
K15	AIR PIPELINE

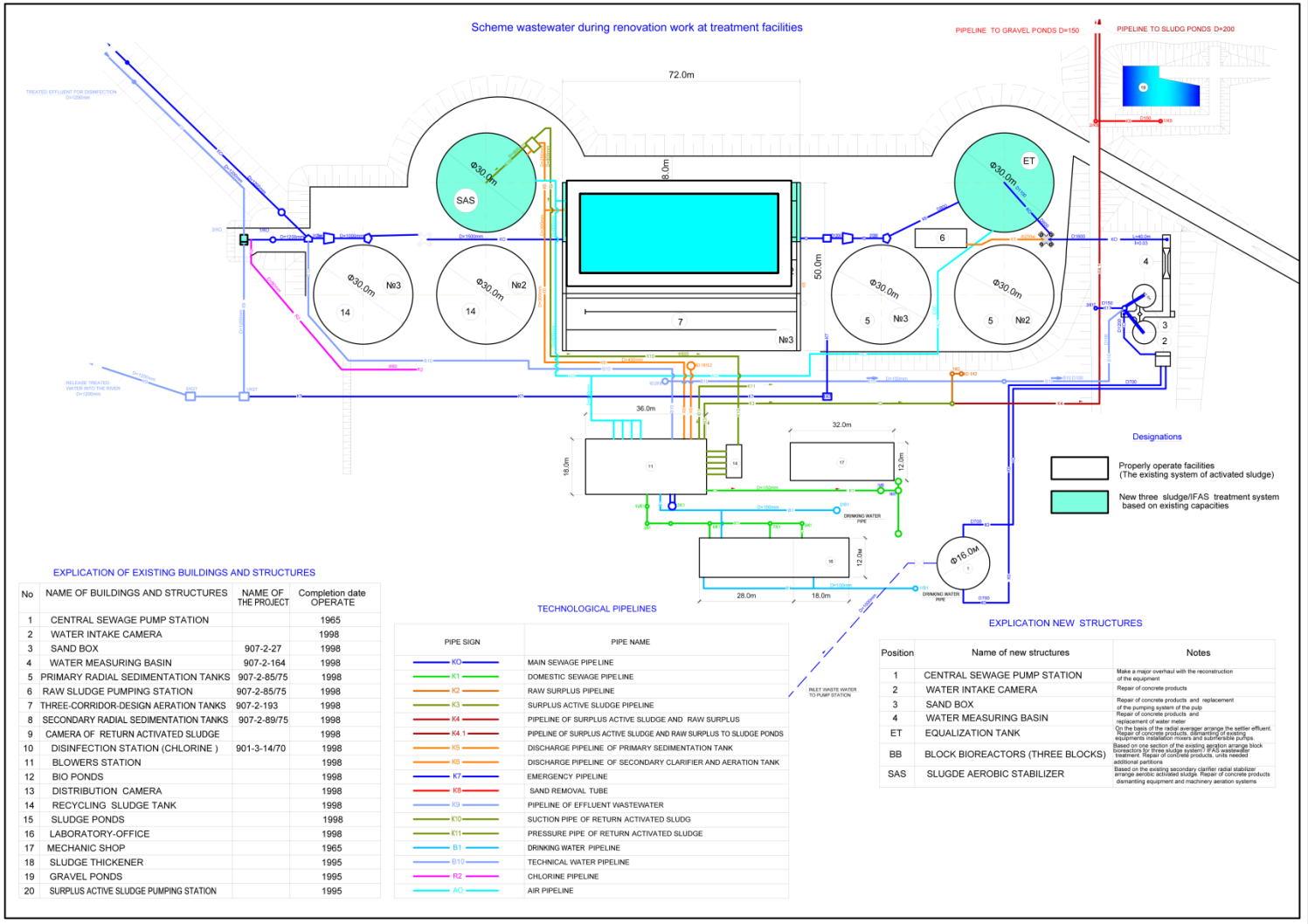
Operation during Construction and Partial Demolition



Operation During Construction



Completed WWTP Redevelopment



EXPLICATION OF EXISTING BUILDINGS AND STRUCTURES

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TECHNOLOGICAL PIPELINES

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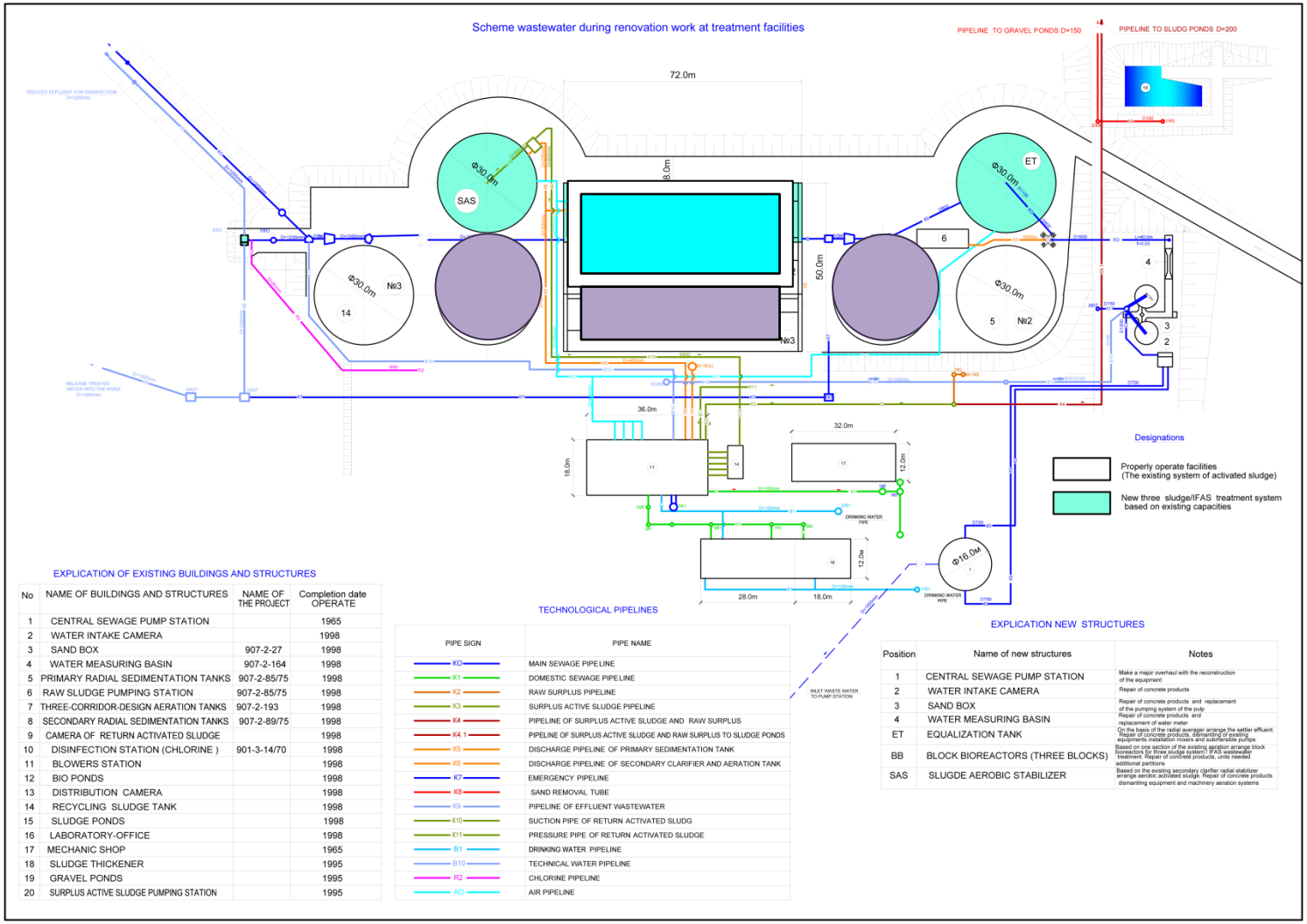
B10	TECHNICAL WATER PIPELINE
R2	CHLORINE PIPELINE
AO	AIR PIPELINE

EXPLICATION NEW STRUCTURES

Position	Name of new structures	Notes
1	CENTRAL SEWAGE PUMP STATION	Make a major overhaul with the reconstruction of the equipment
2	WATER INTAKE CAMERA	Repair of concrete products
3	SAND BOX	Repair of concrete products and replacement of the pumping system of the pulp
4	WATER MEASURING BASIN	Repair of concrete products and replacement of water meter
ET	EQUALIZATION TANK	On the basis of the radial averager arrange the settler effluent. Repair of concrete products, dismantling of existing equipments installation mixers and submersible pumps.
BB	BLOCK BIOREACTORS (THREE BLOCKS)	Based on one section of the existing aeration arrange block bioreactor for three sludge system? If AO wastewater treatment. Repair of concrete products, units needed additional partitions
SAS	SLUGDE AEROBIC STABILIZER	Based on the existing secondary clarifier radial stabilizer arrange aerobic activated sludge. Repair of concrete products dismantling equipment and machinery aeration systems

Completed WWTP Redevelopment with Backup



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4	WATER MEASURING BASIN	907-2-164	1998
5	PRIMARY RADIAL SEDIMENTATION TANKS	907-2-85/75	1998
6	RAW SLUDGE PUMPING STATION	907-2-85/75	1998
7	THREE-CORRIDOR-DESIGN AERATION TANKS	907-2-193	1998
8	SECONDARY RADIAL SEDIMENTATION TANKS	907-2-89/75	1998
9	CAMERA OF RETURN ACTIVATED SLUDGE		1998
10	DISINFECTION STATION (CHLORINE)	901-3-14/70	1998
11	BLOWERS STATION		1998
12	BIO PONDS		1998
13	DISTRIBUTION CAMERA		1998
14	RECYCLING SLUDGE TANK		1998
15	SLUDGE PONDS		1998
16	LABORATORY-OFFICE		1998
17	MECHANIC SHOP		1965
18	SLUDGE THICKENER		1995
19	GRAVEL PONDS		1995
20	SURPLUS ACTIVE SLUDGE PUMPING STATION		1995

TECHNOLOGICAL PIPELINES

PIPE SIGN	PIPE NAME
K0	MAIN SEWAGE PIPELINE
K1	DOMESTIC SEWAGE PIPELINE
K2	RAW SURPLUS PIPELINE
K3	SURPLUS ACTIVE SLUDGE PIPELINE
K4	PIPELINE OF SURPLUS ACTIVE SLUDGE AND RAW SURPLUS
K4.1	PIPELINE OF SURPLUS ACTIVE SLUDGE AND RAW SURPLUS TO SLUDGE PONDS
K5	DISCHARGE PIPELINE OF PRIMARY SEDIMENTATION TANK
K6	DISCHARGE PIPELINE OF SECONDARY CLARIFIER AND AERATION TANK
K7	EMERGENCY PIPELINE
K8	SAND REMOVAL TUBE
K9	PIPELINE OF EFFLUENT WASTEWATER
K10	SUCTION PIPE OF RETURN ACTIVATED SLUDG
K11	PRESSURE PIPE OF RETURN ACTIVATED SLUDGE
B1	DRINKING WATER PIPELINE
B10	TECHNICAL WATER PIPELINE
R2	CHLORINE PIPELINE
AO	AIR PIPELINE

EXPLICATION NEW STRUCTURES

Position	Name of new structures	Notes
1	CENTRAL SEWAGE PUMP STATION	Make a major overhaul with the reconstruction of the equipment
2	WATER INTAKE CAMERA	Repair of concrete products
3	SAND BOX	Repair of concrete products and replacement of the pumping system of the pulp
4	WATER MEASURING BASIN	Repair of concrete products and replacement of water meter
ET	EQUALIZATION TANK	On the basis of the radial averager arrange the settler effluent. Repair of concrete products, dismantling of existing equipments installation mixers and submersible pumps.
BB	BLOCK BIOREACTORS (THREE BLOCKS)	Based on one section of the existing aeration arrange block bioreactor for three sludge system? If AS wastewater treatment. Repair of concrete products, units needed additional partitions
SAS	SLUGDE AEROBIC STABILIZER	Based on the existing secondary clarifier radial stabilizer arrange aerobic activated sludge. Repair of concrete products dismantling equipment and machinery aeration systems

Institutional Development Options and Approach

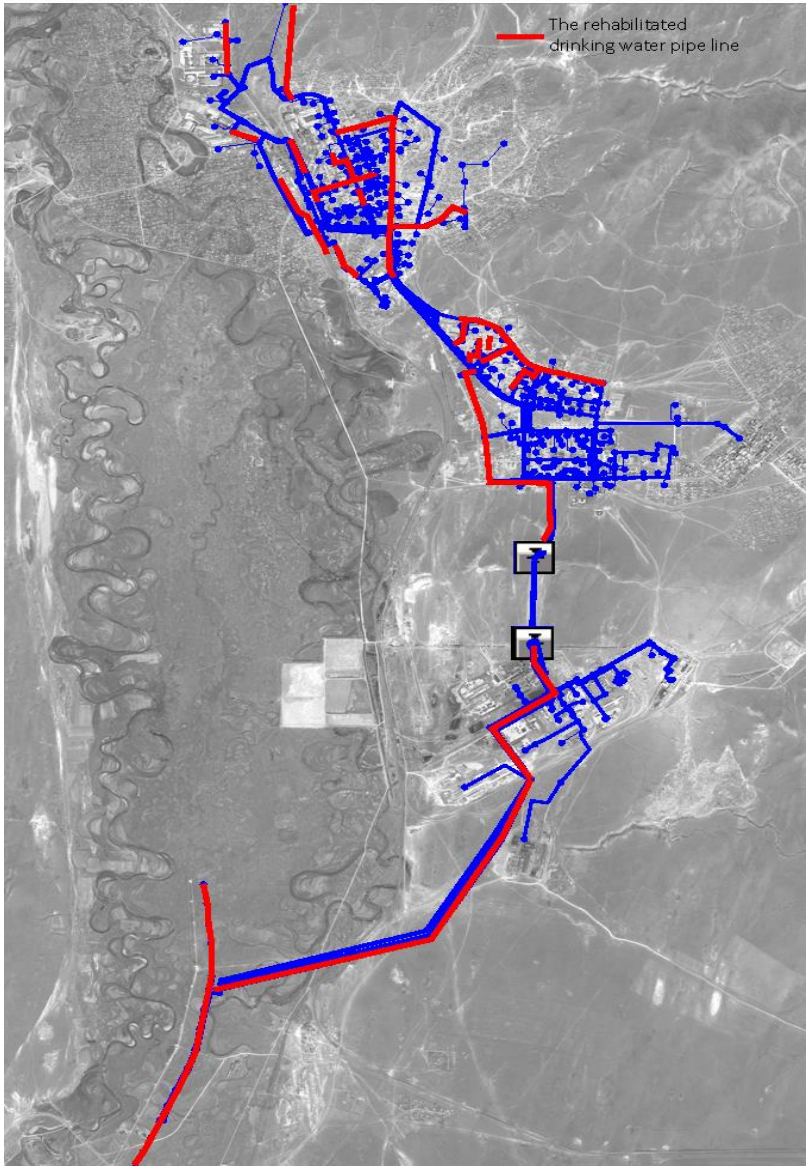
Move towards:

- Greater operational efficiency;
- Reorientation towards customer focus;
- Improved cost recovery and full financial sustainability

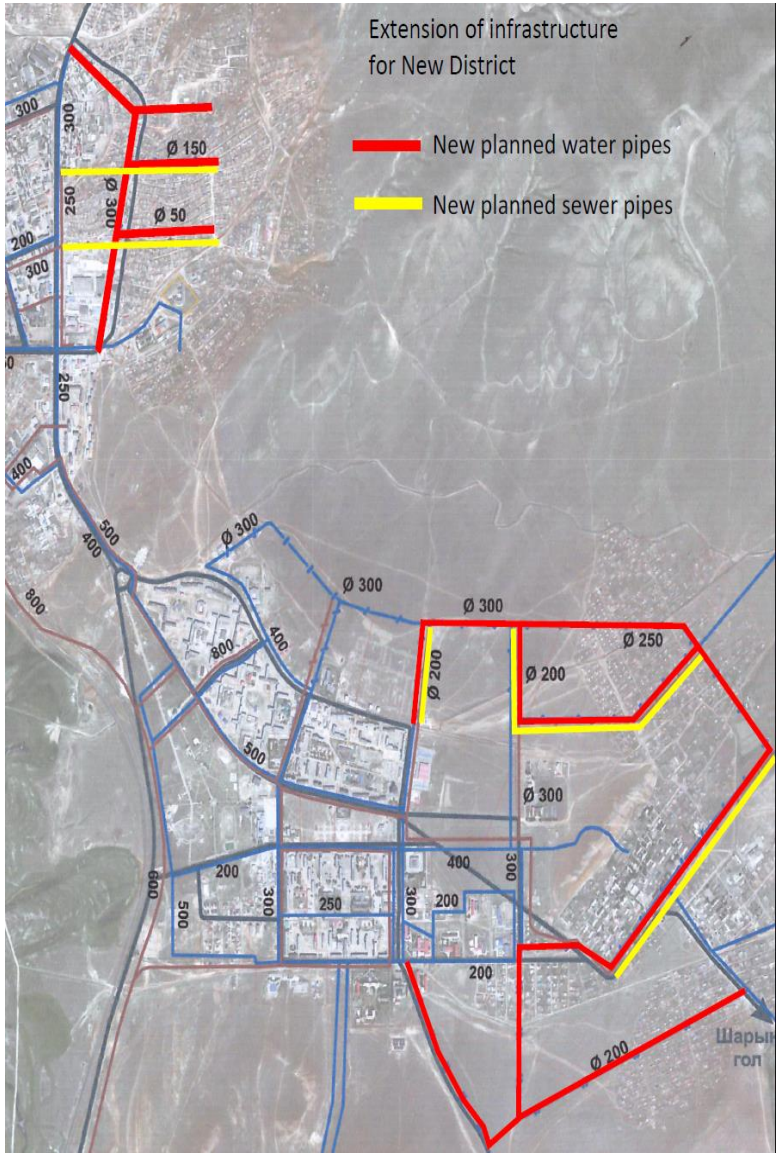
At same time, evaluate and discuss with aimag government longer-term options:

- Bundle WSS with other publically-provided utility services to improve viability (i.e. heating and power)
- In line with overall sector reform in Mongolia, adopt progressive move towards an enhanced role for the private sector (lease, concession, ownership etc.)

Existing Water Supply System Improvements: Stages 1 and 2

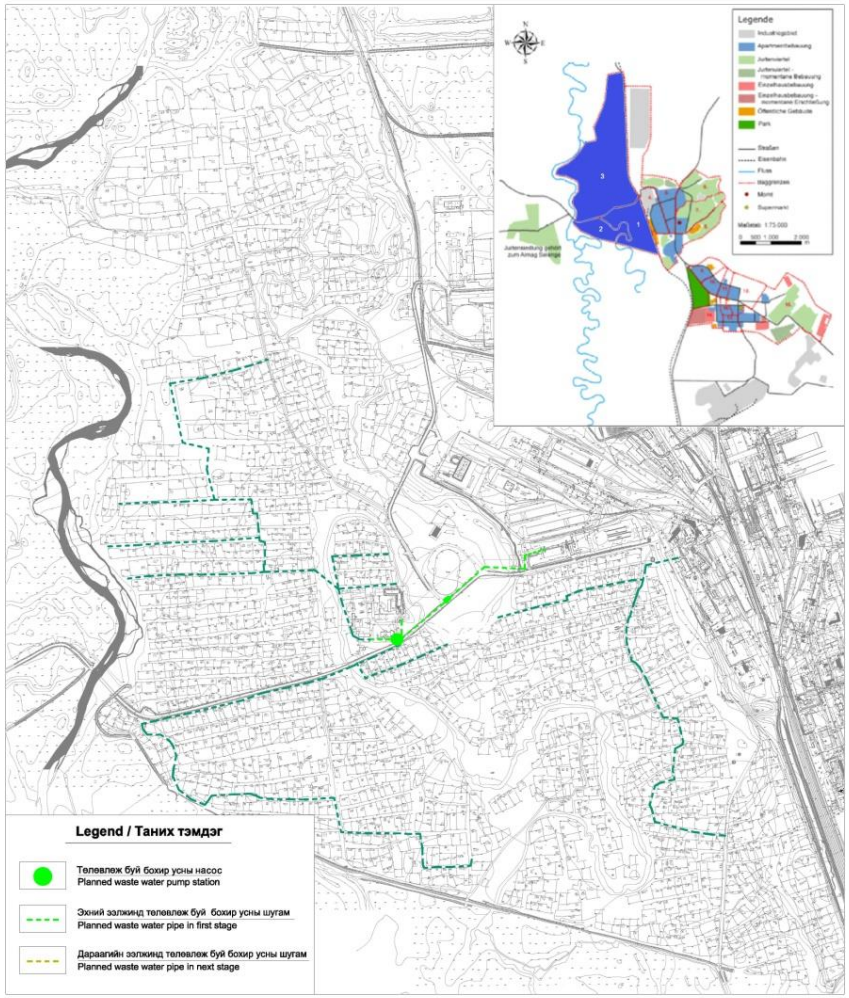


Extension Area Water Supply and Sewerage Extensions Stages 1, 2 and 3

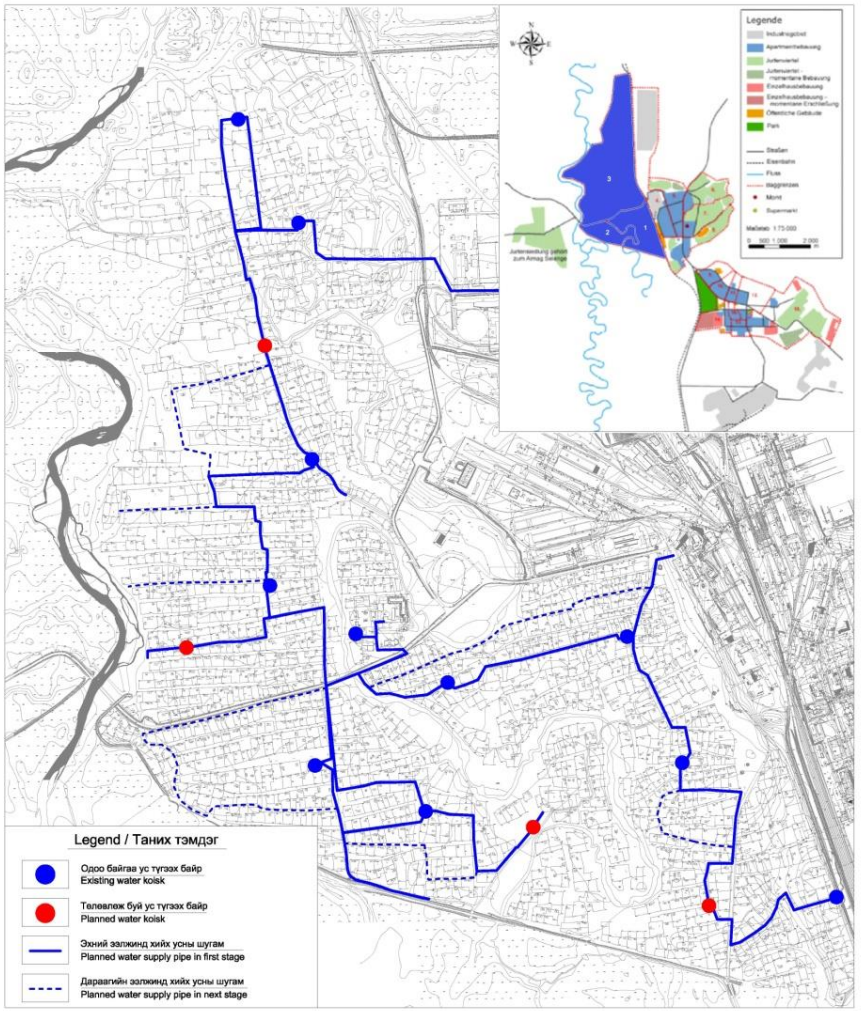


Incremental System Extensions: Baghs 1,2 & 3

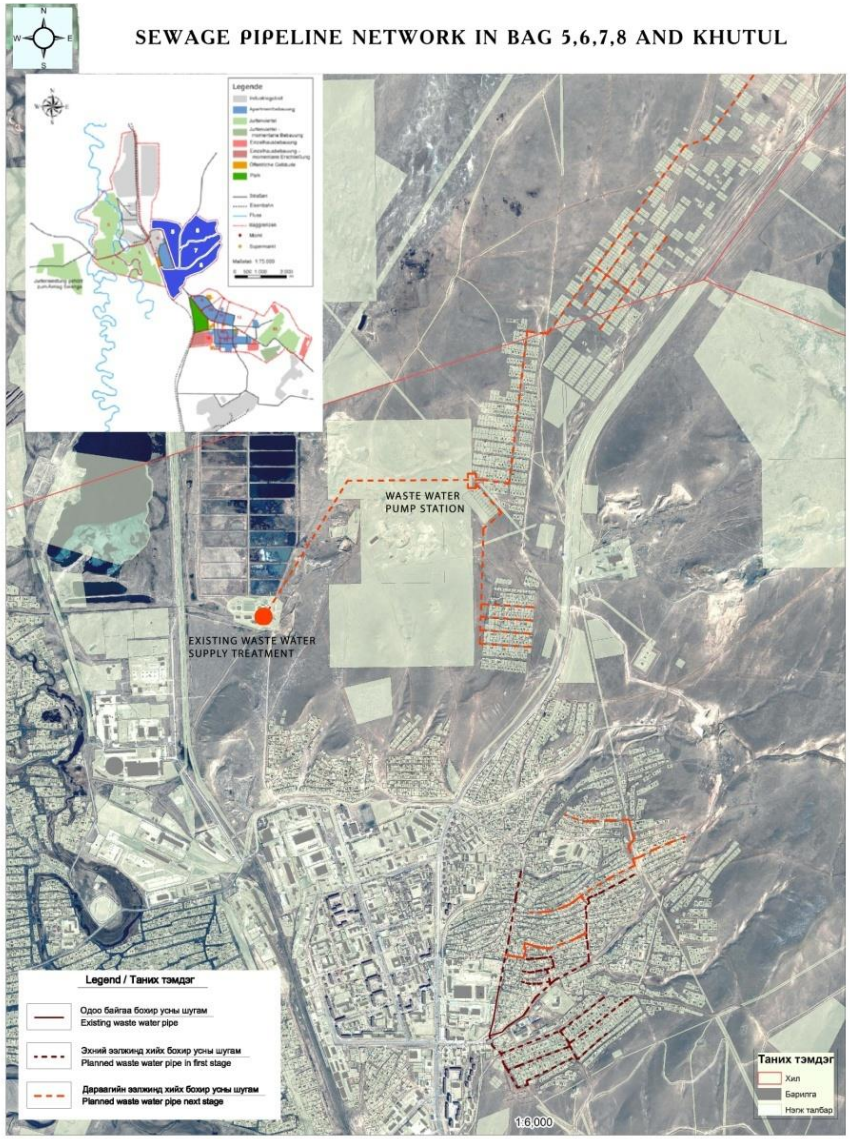
SEWAGE PIPELINE NETWORK IN BAG 1, 2 AND 3

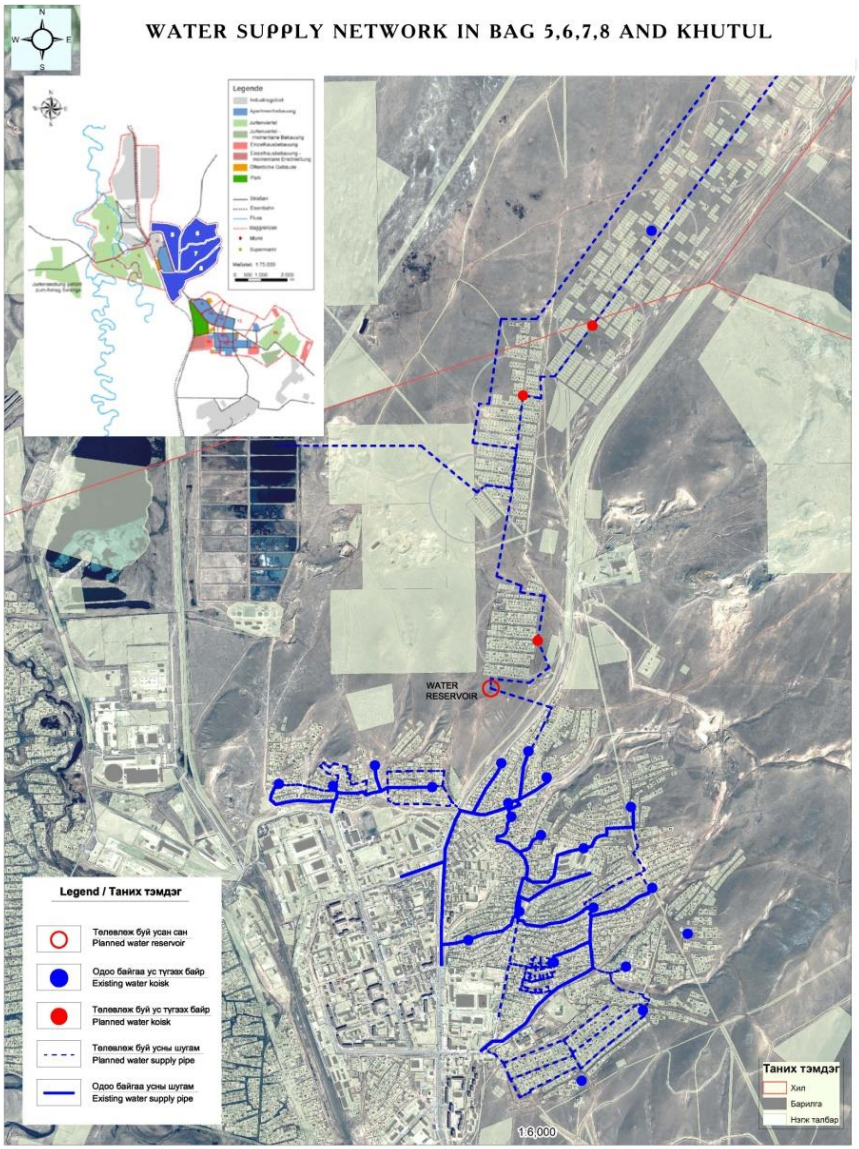


WATER SUPPLY PIPELINE NETWORK IN BAG 1, 2 AND 3

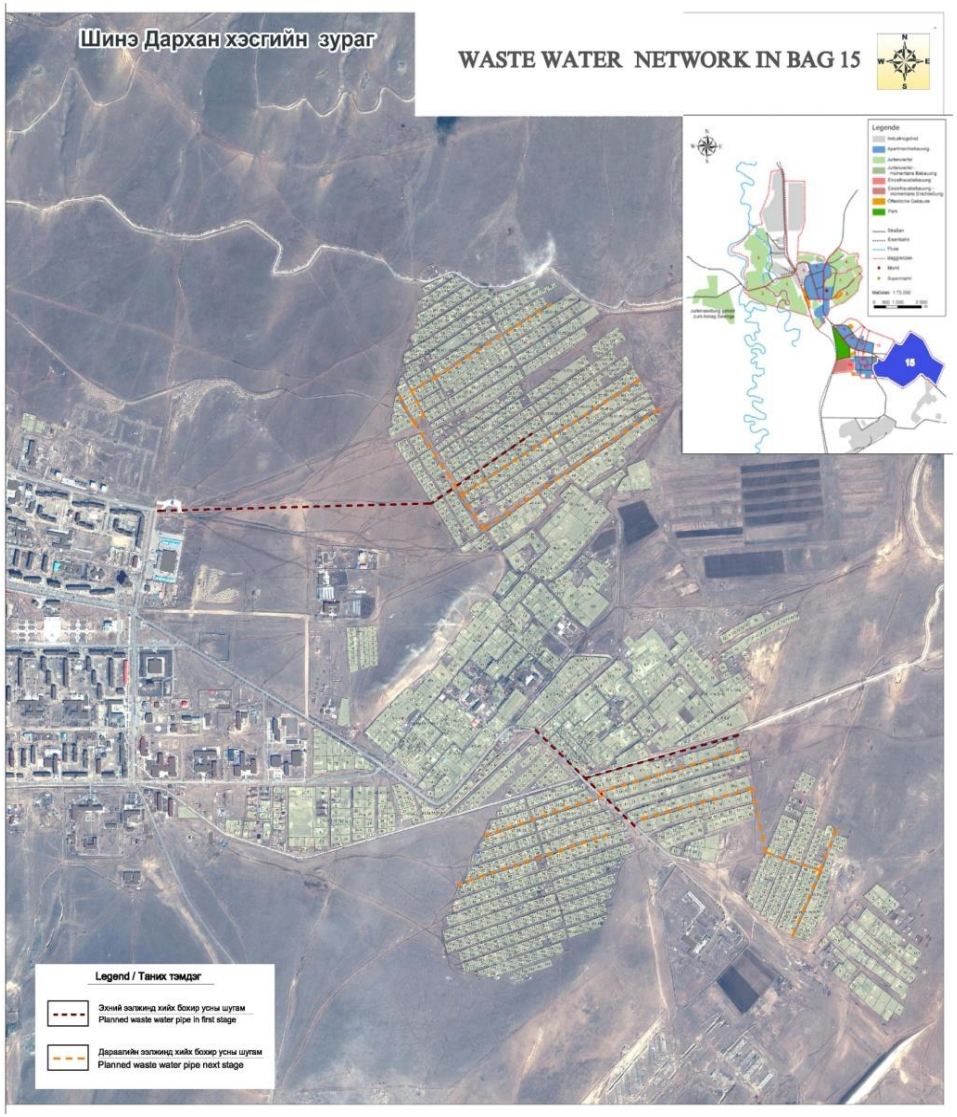


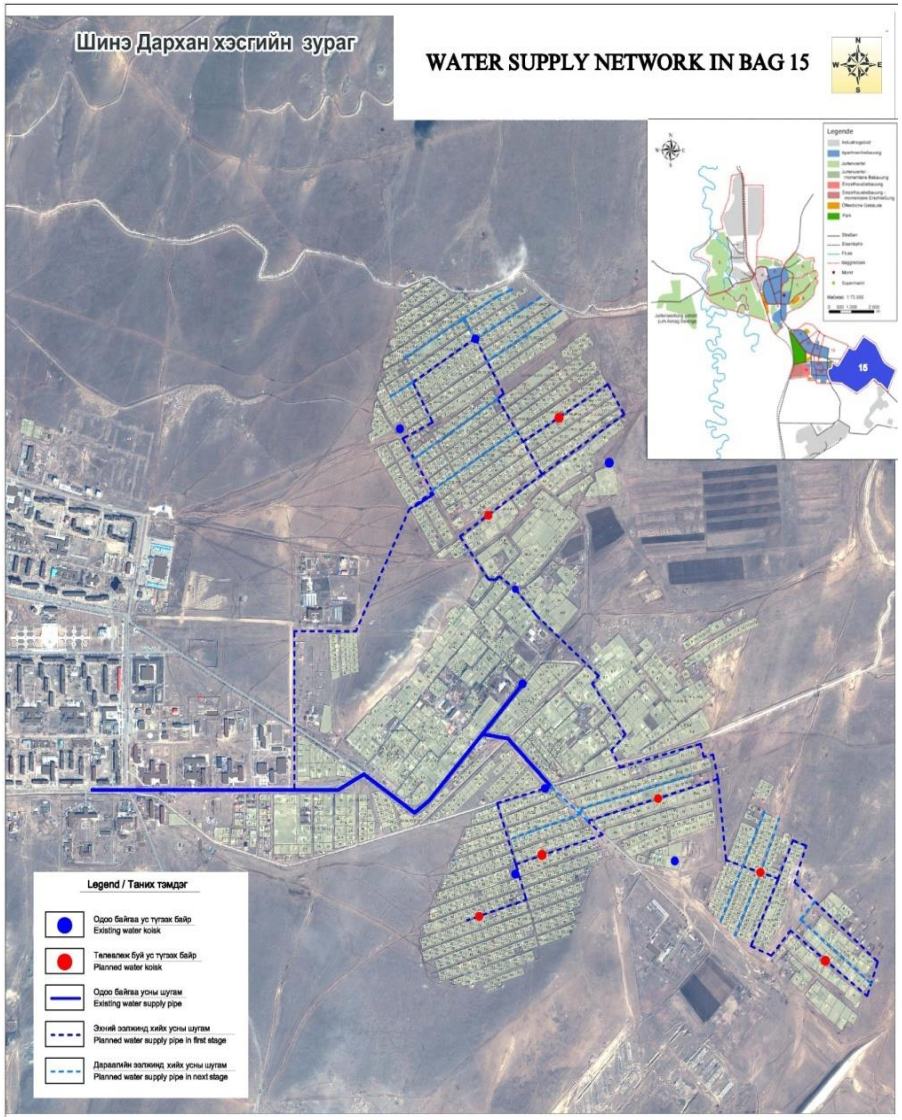
Incremental System Extensions: Baghs 5 to 8



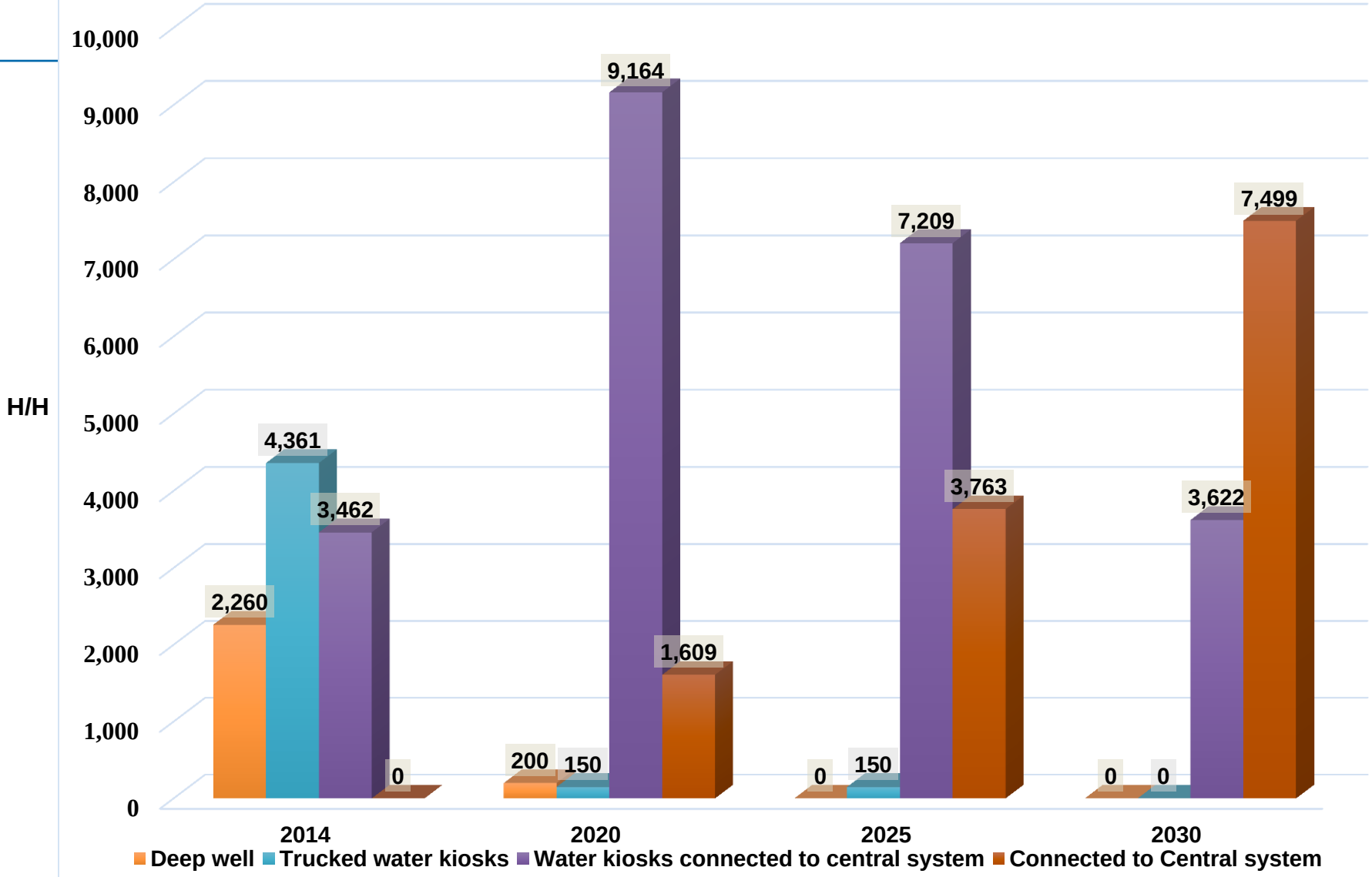


Incremental System Extensions: Bagh 15

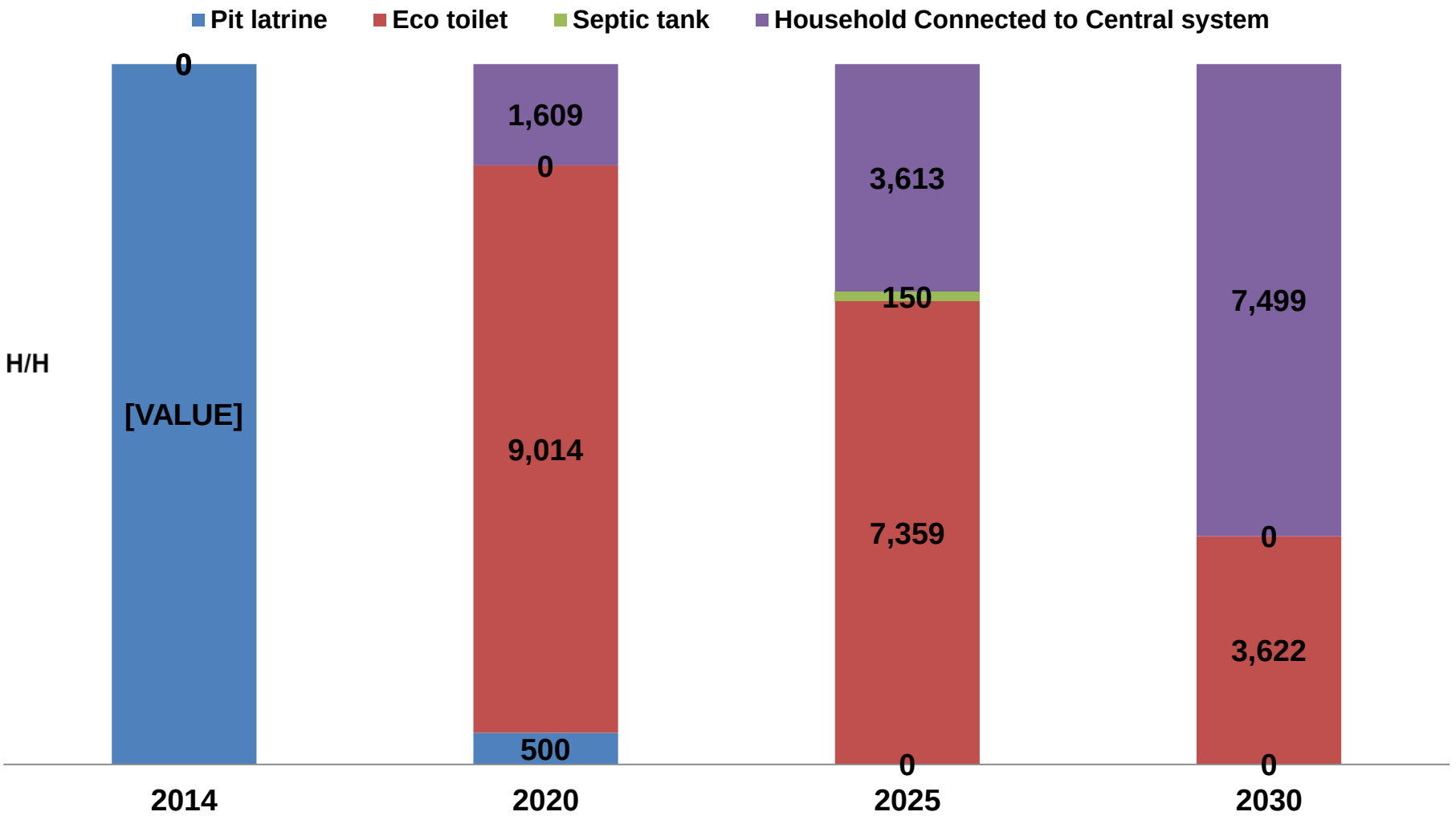




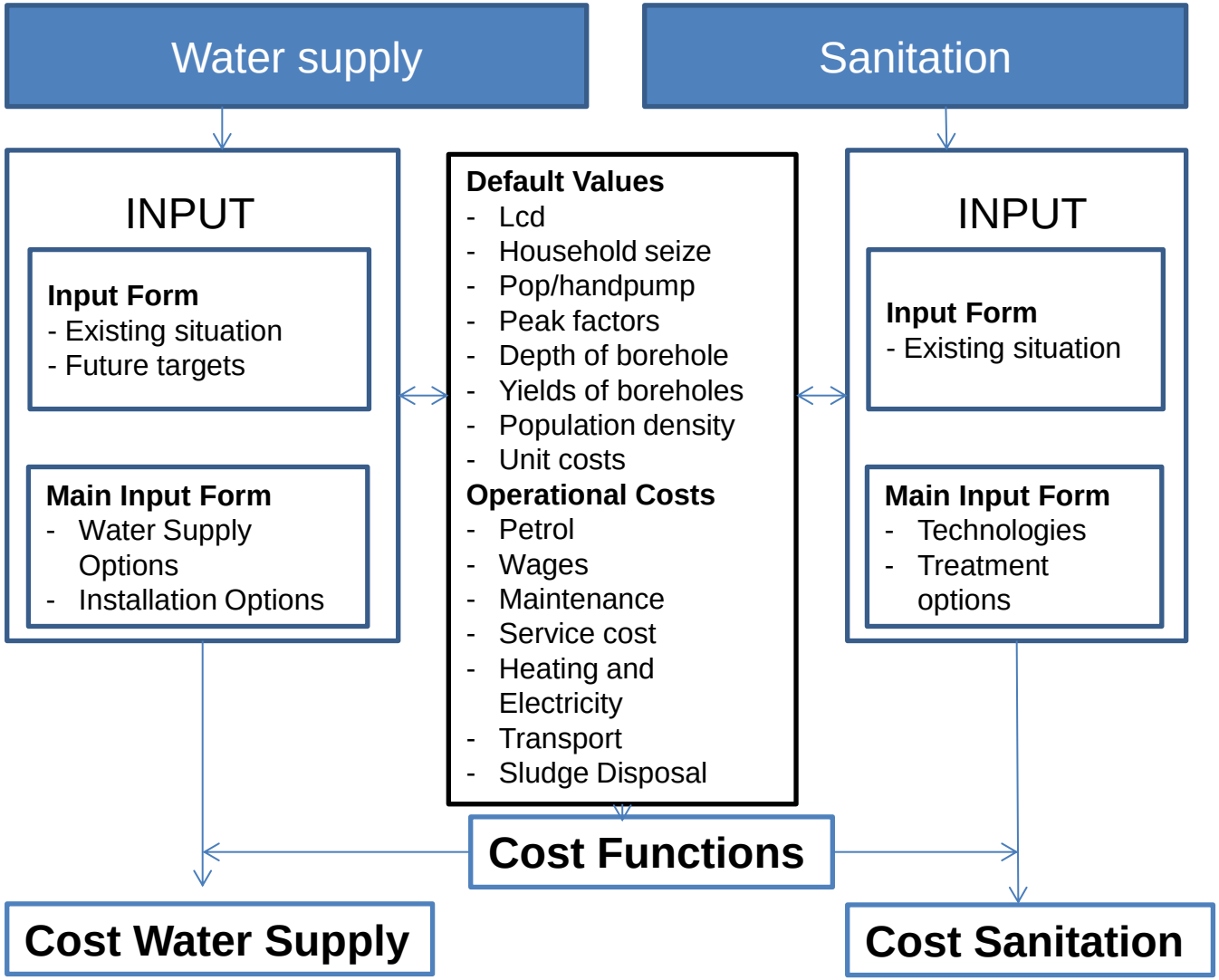
Water Supply Coverage by Source in Ger Areas



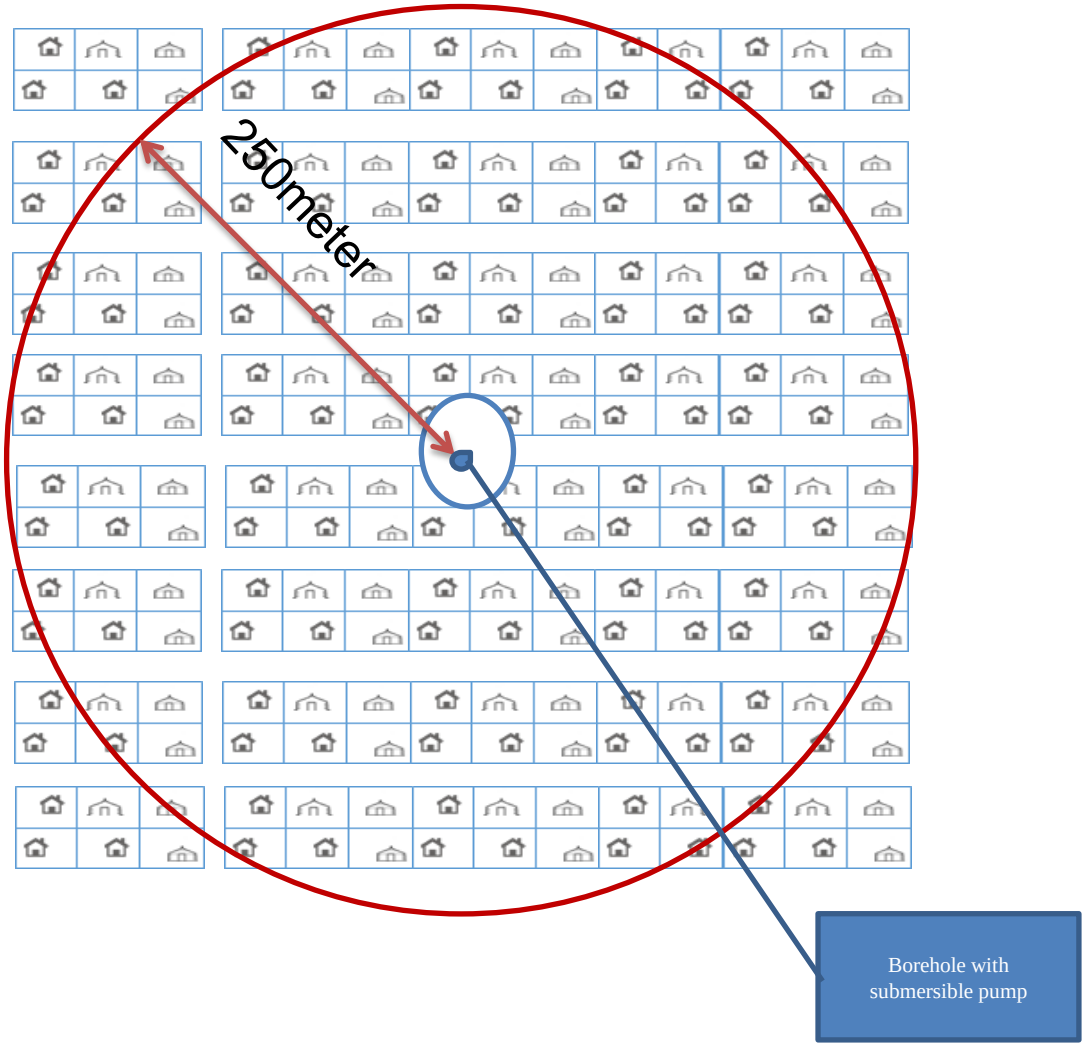
Coverage by Type of Sanitation in Ger Areas



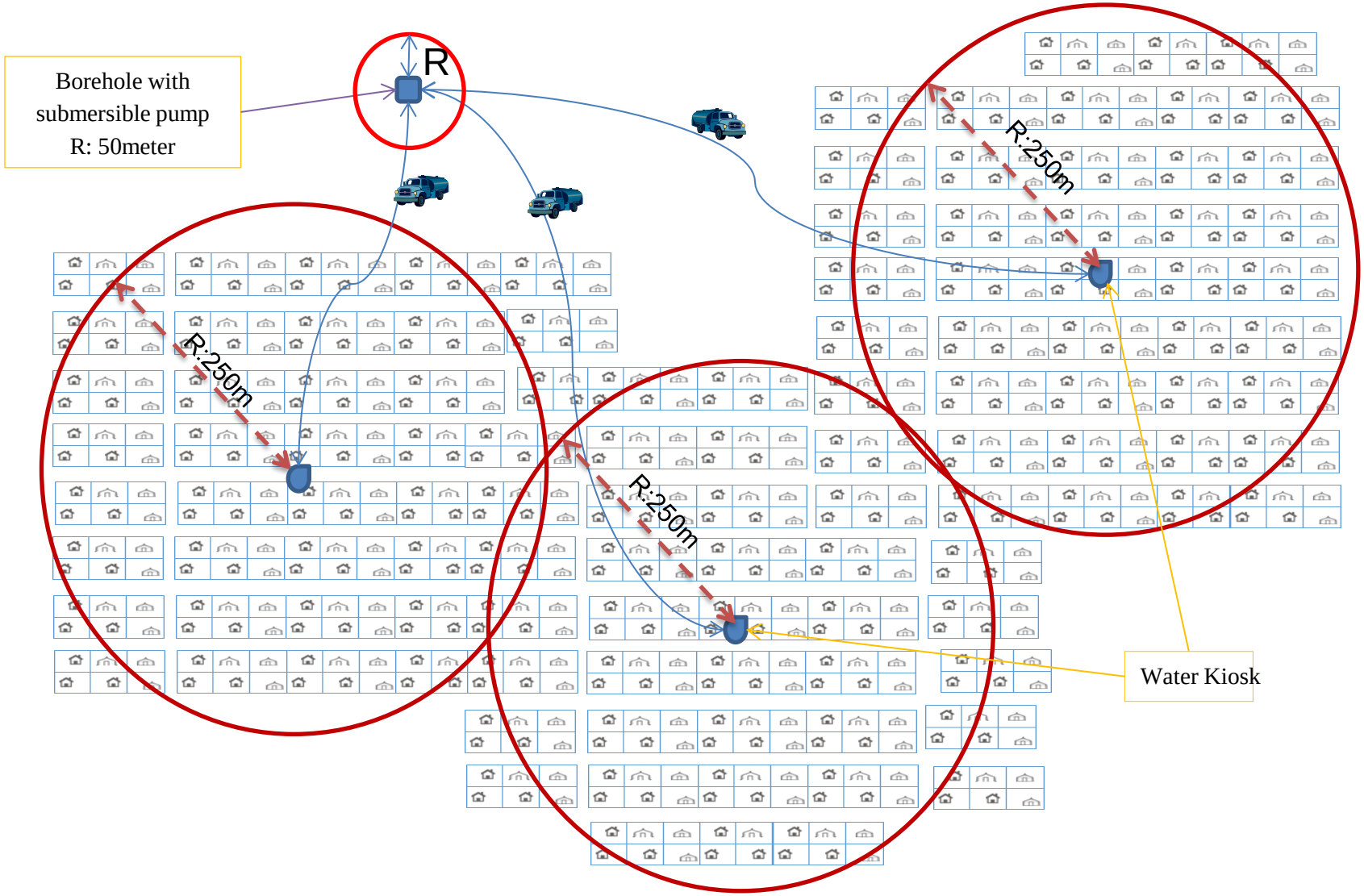
Ger Area Water and Sanitation Options Model: Basic Diagram



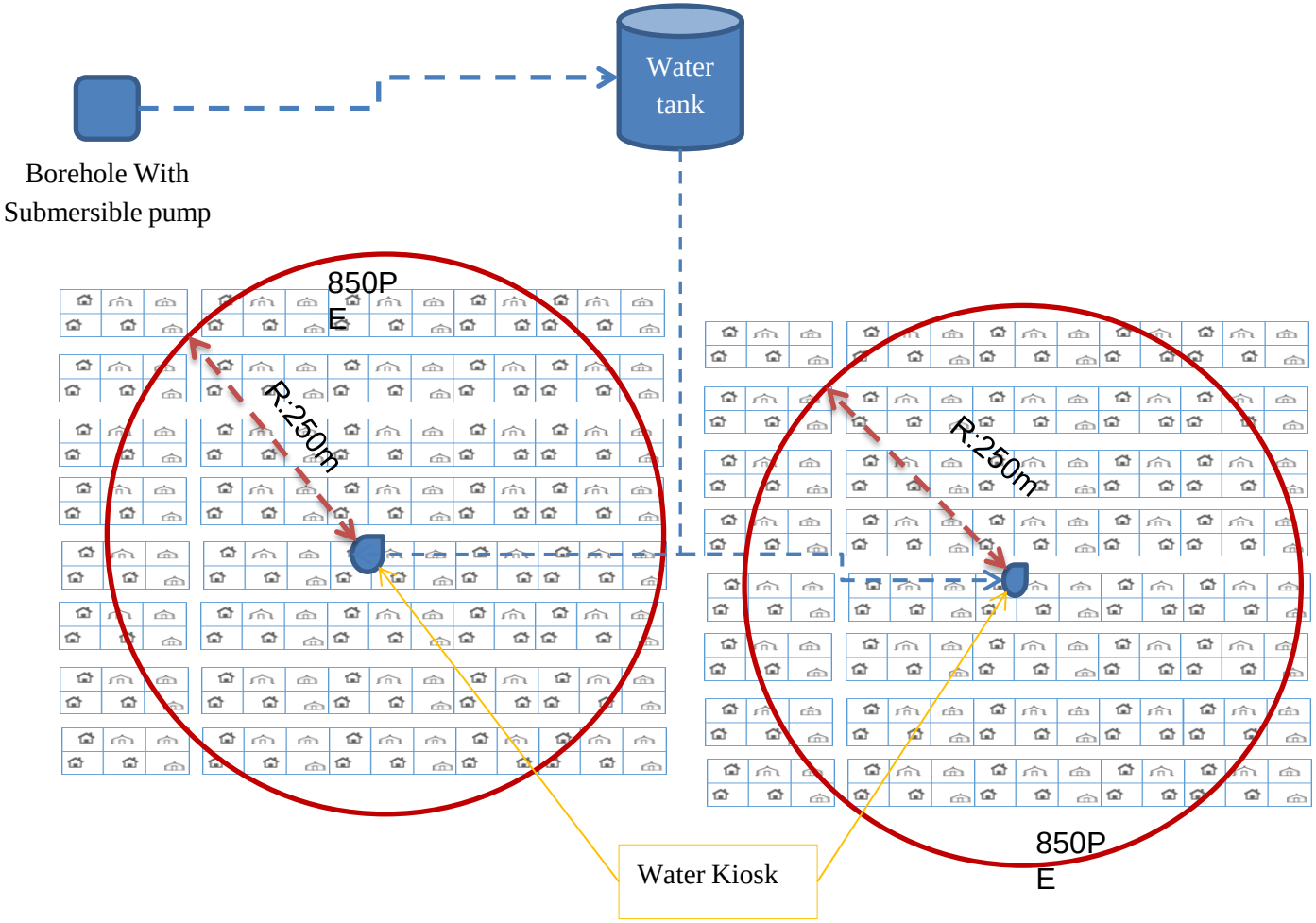
Level 1



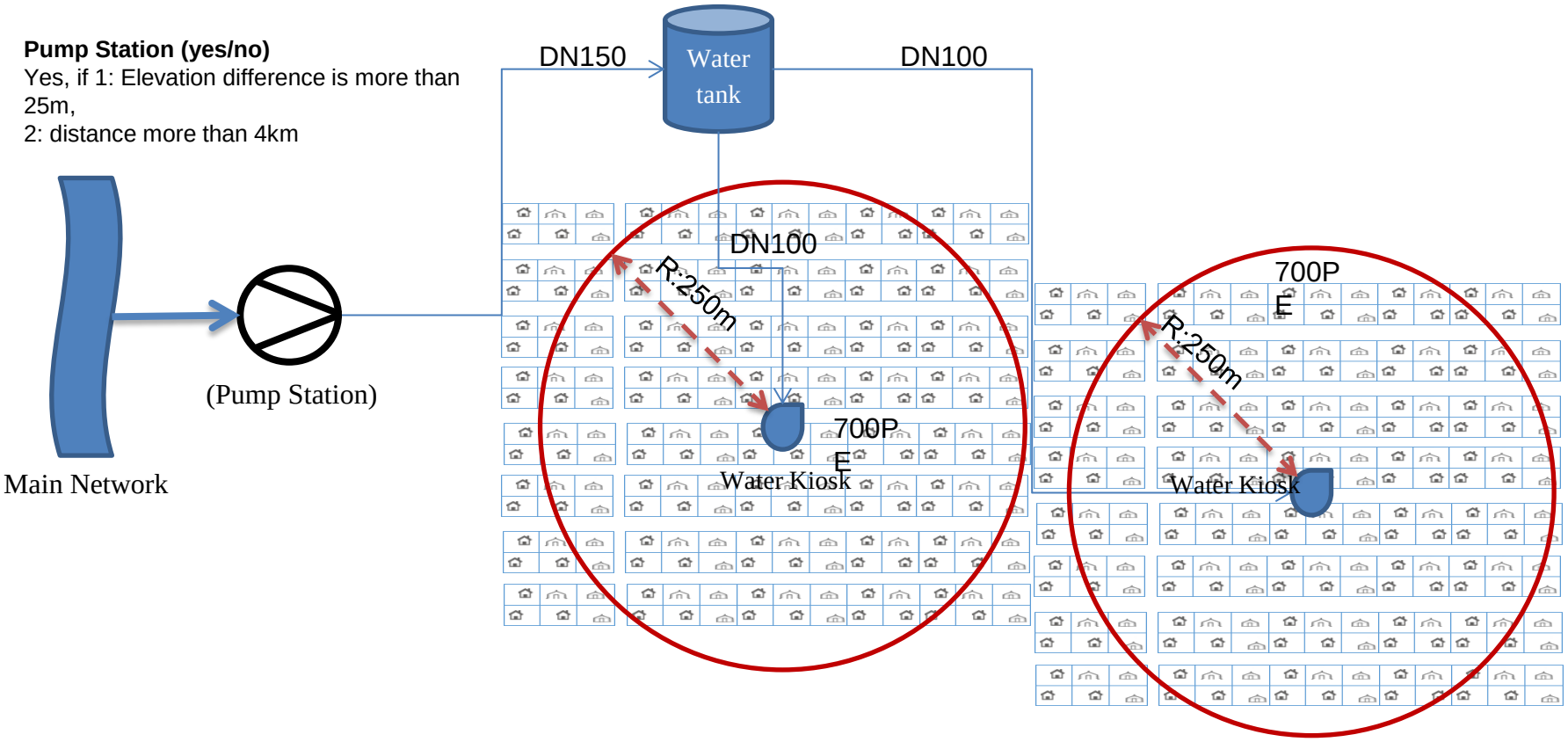
Level 2


Borehole with submersible pump R: 50meter
R
R:250m
R:250m
R:250m
Water Kiosk

Level 3

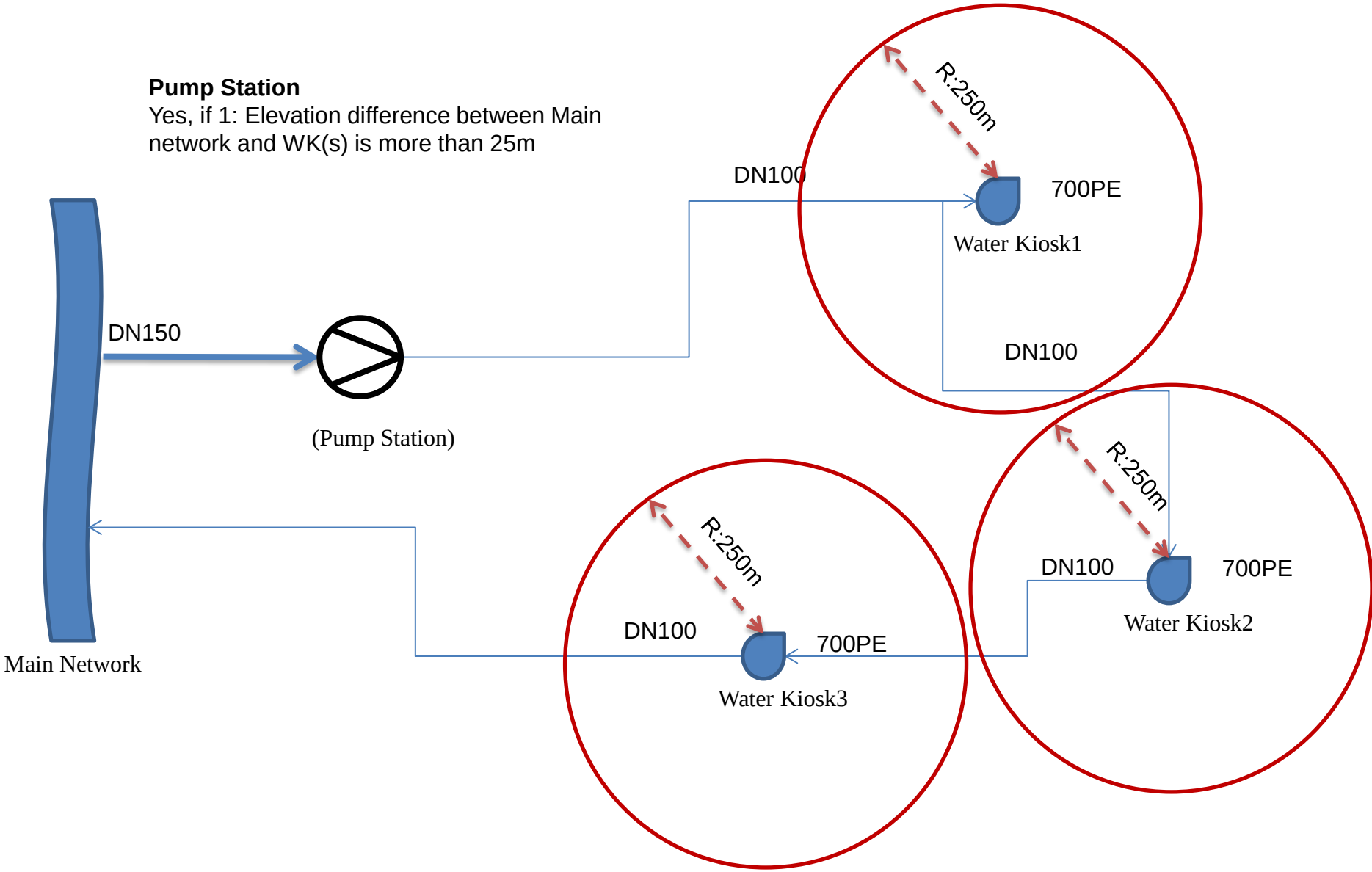

Water tank
Borehole With Submersible pump
850P E
R:250m
R:250m
Water Kiosk
850P E

Level 4

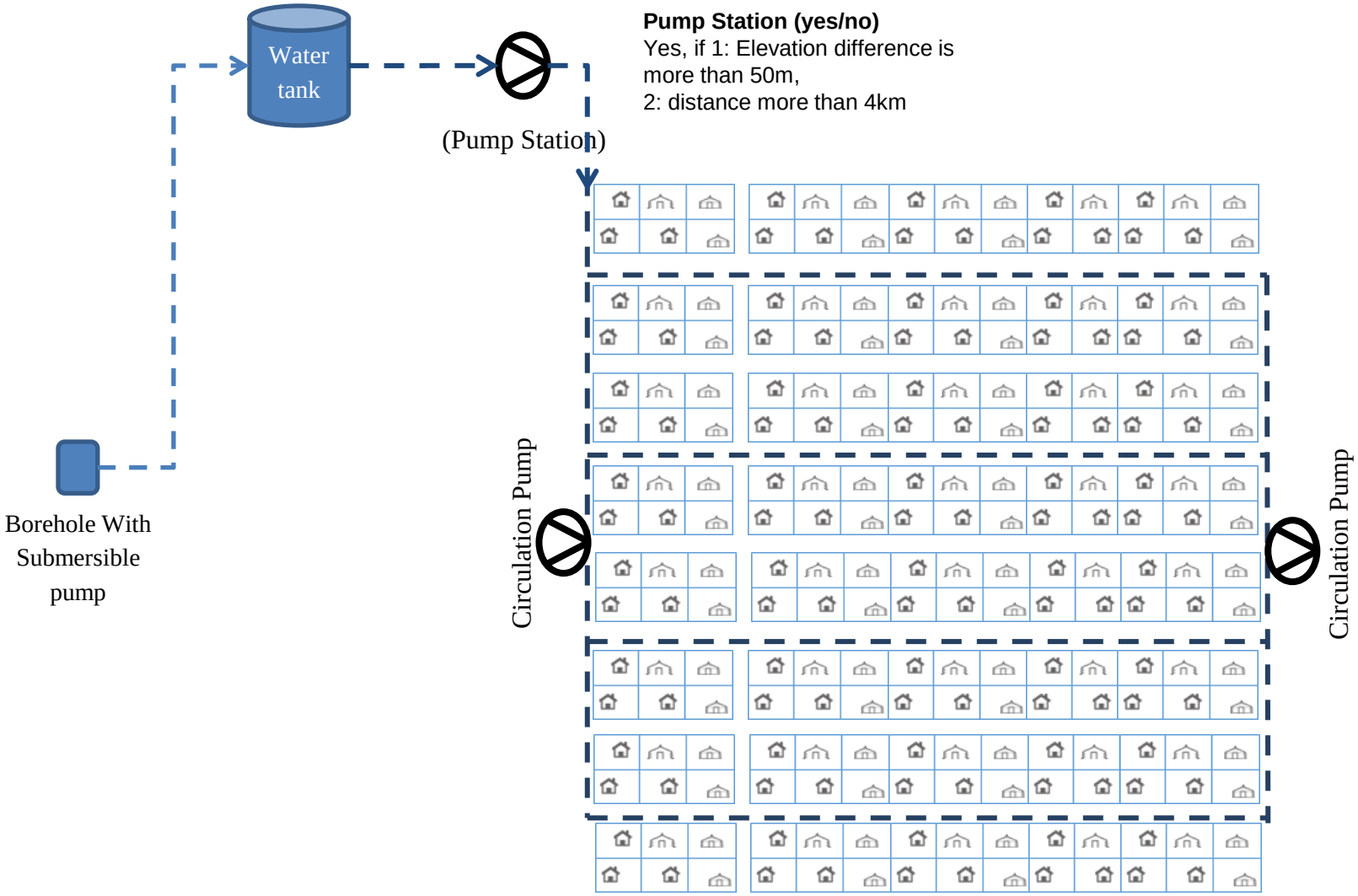

Pump Station (yes/no)
Yes, if 1: Elevation difference is more than 25m,
2: distance more than 4km
DN150
Water tank
DN100
DN100
R:250m
700P
E
Water Kiosk
(Pump Station)
Main Network
700P
E
R:250m
Water Kiosk

Level 5

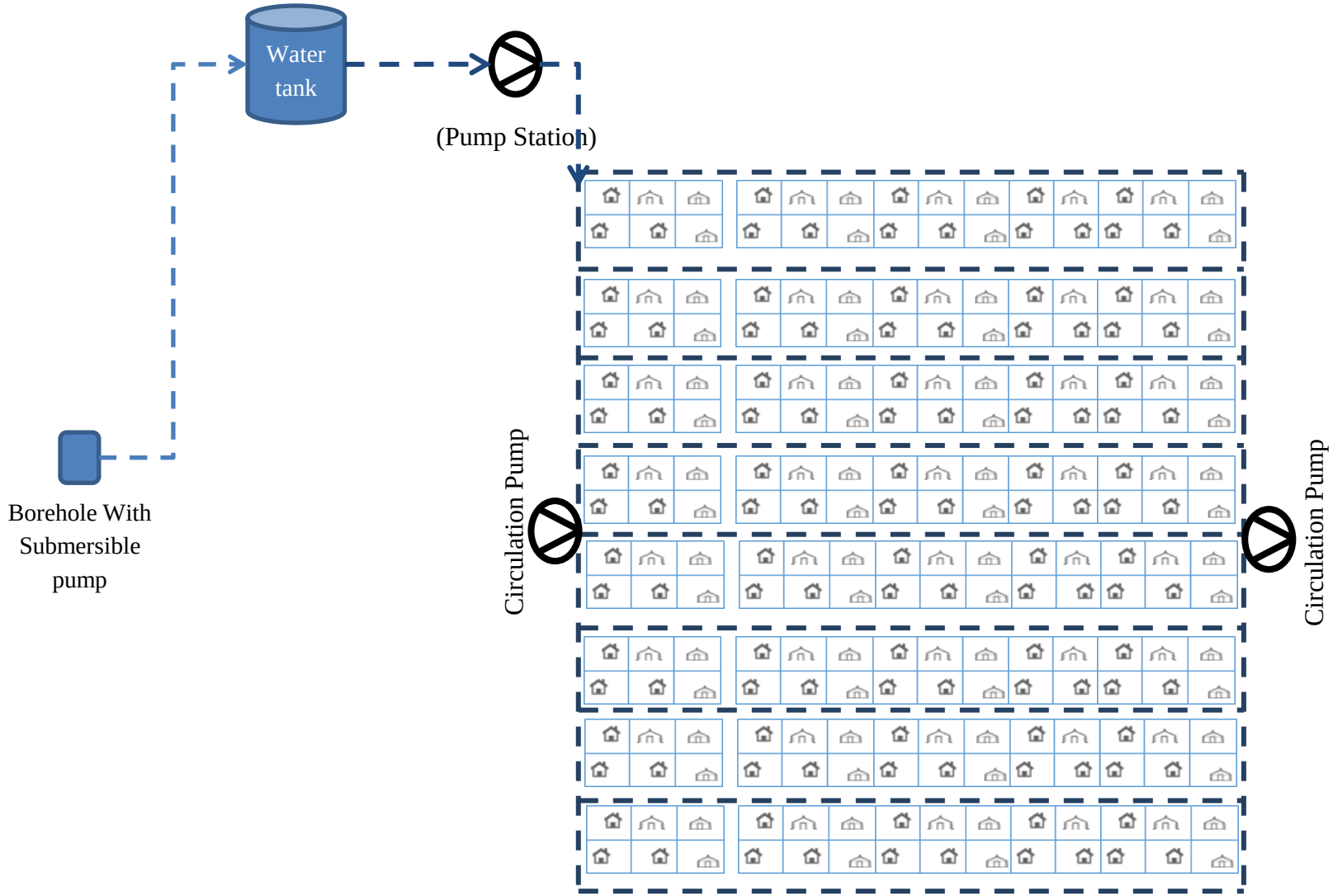
Pump Station
Yes, if 1: Elevation difference between Main network and WK(s) is more than 25m



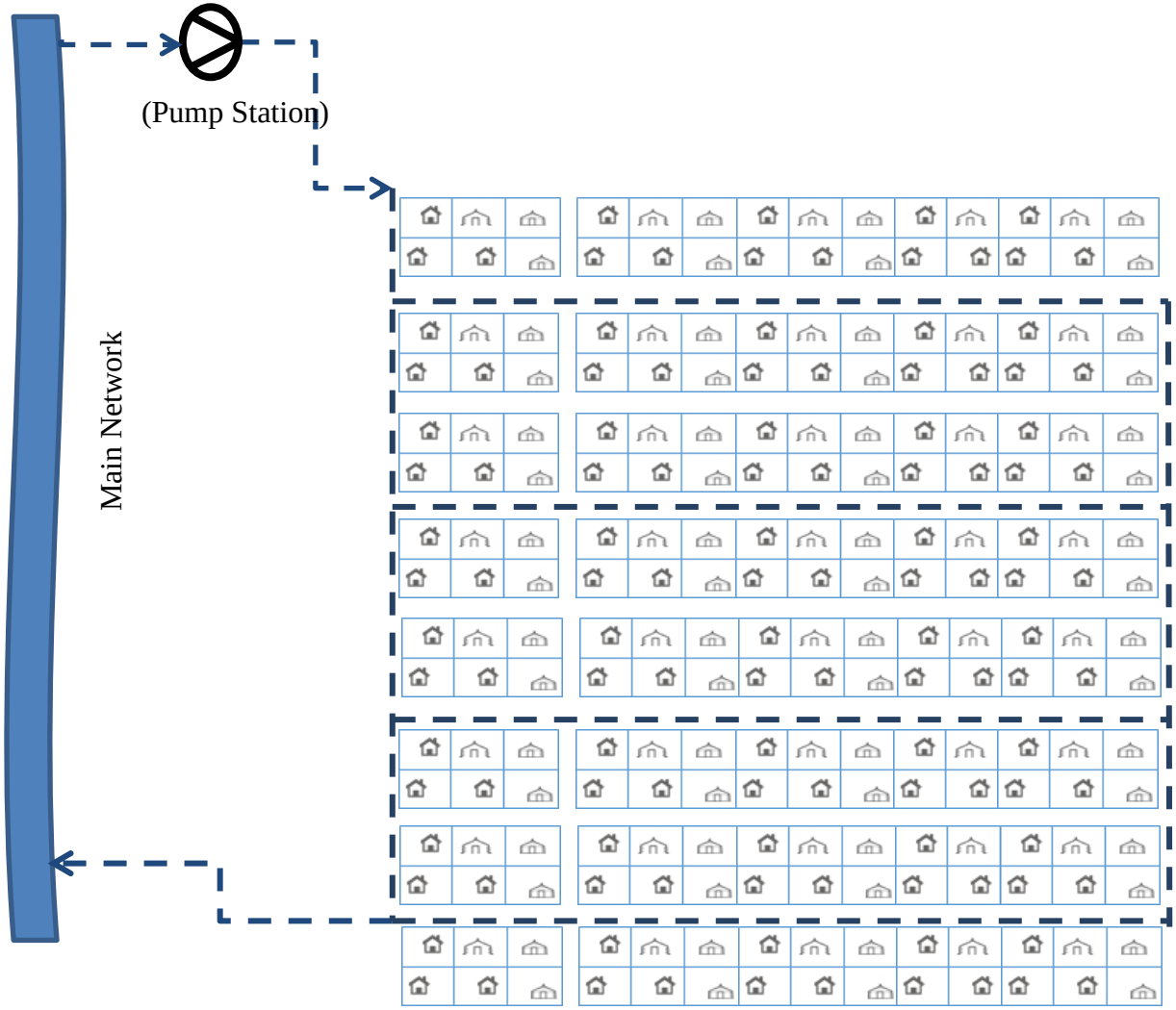
Level 6.1 (Easement/Servitude)



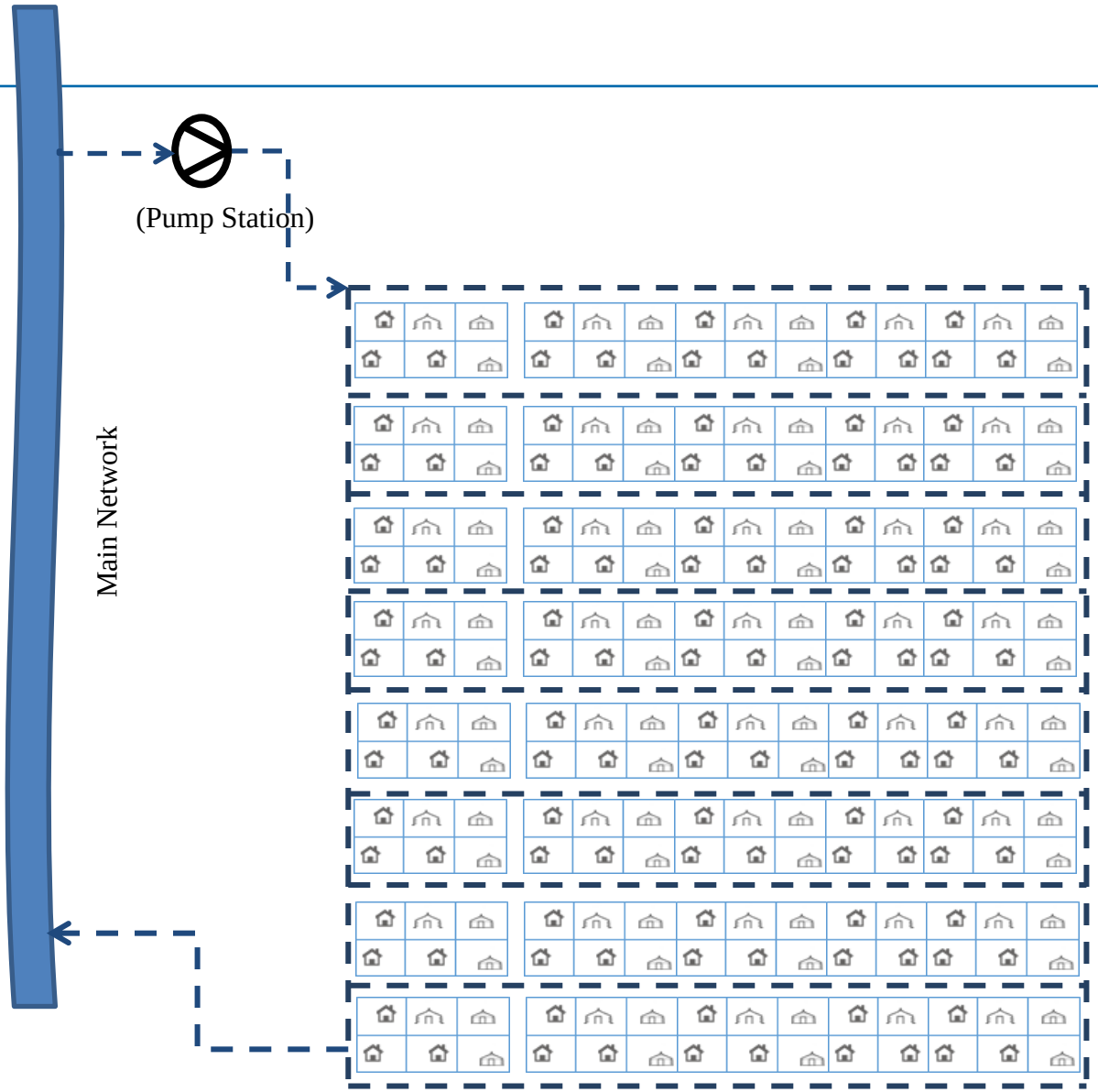
Level 6.2


Water tank
(Pump Station)
Borehole With Submersible pump
Circulation Pump
Circulation Pump

Level 7.1 (Easement/Servitude)



Level 7.2



Forthcoming ADB - CDIA joint initiatives

Possible ADB financing of Darkhan Components identified in CDIA PFS

EASS and CDIA

- Mongolia national Urban Assessment (UB, Erdenet) - 2015
- Affordable Housing and Infrastructure improvement for UB City – PFS - 2015

ADB's new Office of Public-Private Partnership and CDIA

- Central Heating Power Plant 5 Infrastructure for UB City – PFS -2015

ADB to consider support of CDIA CIIPP and PFS

- Water Supply and Sanitation for Erdenet City – Q4-2015 -2016

Thank you!