



Capability Statement

Water and Environmental Engineering

TABLE OF CONTENTS

1	GROUP PROFILE & PHILOSOPHY	1
2	ILF – PROFESSIONAL COMPETENCE IN WATER & ENVIRONMENTAL ENGINEERING	2
3	ILF – SERVICES	7
4	CONTACT & REFERENCES	13



1 GROUP PROFILE & PHILOSOPHY

Group Profile

The ILF Group is an international engineering and consulting firm that has been helping its clients successfully execute technically demanding industrial and infrastructure projects for **more than 50 years**.

With **2,000 highly qualified employees** at more than **40 office locations** across five continents, the companies of the ILF Group have a strong regional presence.

This enables ILF to interact with clients and project parties on site. At the same time, close cooperation within the network of the ILF Group makes it possible to draw on international experts and make use of their special experience, processes, and tools.

The combination of local presence and international expertise ensures that client needs are met in the best possible way. The company is privately owned by the founding families and is therefore completely independent. It has no affiliation with manufacturers, suppliers, or financial institutions.

ILF's main **business areas** are:

- Energy & Climate Protection
- Water & Environment
- Transportation & Structures
- Oil, Gas & Industrial

Vision, Values & Beliefs

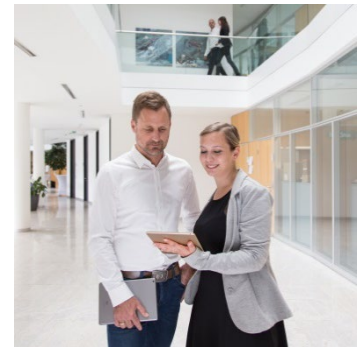
At ILF, we passionately devote our energy to pursuing the vision of **improving the global quality of life**. This is what drives us and makes us believe in our work.

We are motivated by our ambition to achieve **market leadership through quality**. This is why we focus on a structured approach to problem solving and constantly strive to improve. But above all, it is our great people that really make the difference. We truly believe in **respect, honesty, reliability** and **fairness** as a solid foundation for all our interactions.

We continue to spearhead **Engineering Excellence**. Our independence allows us to provide creative solutions while continuously acting in every client's best interest.



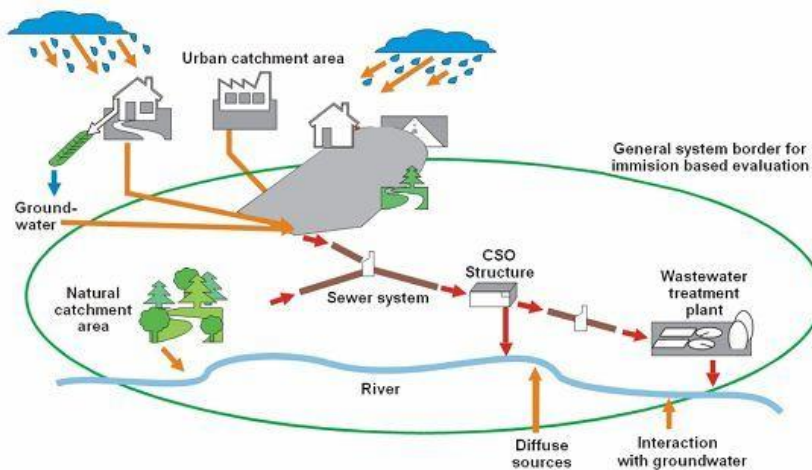
CEO Klaus Lässer



2 ILF – PROFESSIONAL COMPETENCE IN WATER & ENVIRONMENTAL ENGINEERING

ILF – Water and environmental engineering

Water and environmental engineering encompasses a wide scope of services ranging from **water resource development** and **water treatment, water distribution** and **wastewater disposal** to **wastewater treatment** and **water reuse**.

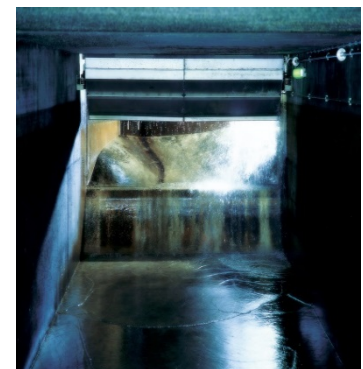
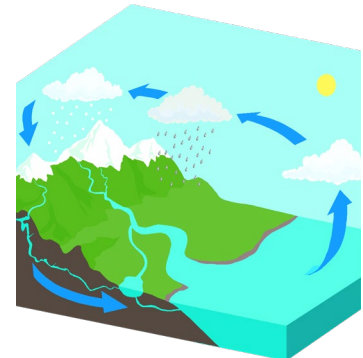


© Universität Innsbruck (http://www.uibk.ac.at/aie/projekte/iut/a_pr.html)

Water follows a **natural cycle**. It is used but not consumed. This implies that the total amount of water neither increases nor decreases. As water and environmental engineering experts we are committed to delivering customised designs and tailor-made solutions for all water supply and disposal aspects.

Depending on the respective needs – **design, upgrade or rehabilitation** – we partner with our clients to assist them in preparing, planning, designing and implementing their projects. In order to provide optimum solutions to our clients, both in technical and economic terms, we take a pro-active approach to changing conditions and look at processes in detail and in their entirety.

We aim at achieving a holistic **optimisation** of all facilities with regard to cost-efficiency during construction and operation, environmental sustainability, likelihood of receiving authority approval and operational safety.



Capability Statement Water and Environmental Engineering

Our team of experts has a high level of engineering competence and a great wealth of professional experience. For more than thirty years ILF has been developing tailor-made solutions **for complex water and environmental engineering projects at home and abroad:**

- Water resource development and water treatment systems
- Water transmission and storage systems
- Water supply and wastewater disposal networks
- Wastewater treatment systems incl. energy-efficiency optimisation
- Water reuse after cleaning processes
- Wastewater heat recovery systems



ILF – Added Value

- **One-stop-shop principle** – interdisciplinary approach by in-house experts with specialist knowledge in hydraulic engineering and hydrology including simulation and modelling, geology, hydrogeology, geotechnics, environmental and process engineering, electrical as well as instrumentation and control engineering, mechanical engineering, architecture, structural engineering, business engineering and last but not least water and environmental engineering
- **Comprehensive concepts** – considerable improvement of design reliability and as a result optimisation of cost and operation efficiency
- **Client-specific solutions** – constant focus on our clients' needs during all phases of the project – tailor-made projects taking the respective boundary conditions into consideration and making use of ILF's extensive project experience from current and completed projects
- **Cost-effective integrated solutions** – efficient combination of water and environmental engineering projects and energy recovery solutions due to close in-house cooperation with ILF's Hydropower, Dam and River Engineering business unit
- **Long-standing experience** – well-informed and target-oriented project implementation in strict compliance with legal framework conditions, especially during permit application, tender and construction phases; market-oriented tender packages and cost estimates
- **Ongoing projects** – continuous development of state-of-the-art technologies and up-to-date working practices due to ongoing involvement in projects



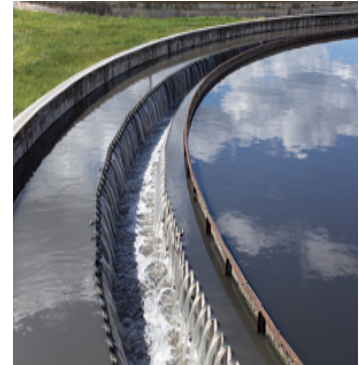
ILF – Milestones (selected international projects)

- Design of drinking water and irrigation water supply and wastewater disposal systems for the South Dhahran Home Ownership Project (SDHO) for a new district of approx. 70,000 inhabitants as well as for existing districts; sea water desalination plant with reverse osmosis as well as wastewater treatment plant, 70,000 m³/day with additional treatment stage for irrigation water; drinking water transmission line with a capacity of 100,000 m³/day and a length of 20 km, wastewater trunk line, with a capacity of 70,000 m³/day, and a length of 17+10 km), including pumping stations, Saudi Arabia
- Adaptation of water supply and wastewater disposal systems in 10 out of 41 counties for a total of 5.2 million inhabitants; preparation of master plans, feasibility studies and cohesion fund applications, Romania
- Reduction of water losses in the drinking water supply system serving four districts in the city of Zarqa; preparation of a feasibility study as well as design and tendering services for wells, spring water intake structures, elevated tanks, chlorination facilities, water mains, pumping stations and distribution network, Jordan
- Supervision of construction works undertaken to rehabilitate the water supply systems in 17 towns in Georgia (scope extended to 21 towns by the client) as part of the donor-financed Water Infrastructure Modernisation Project (WIMP); project funding by the Republic of Georgia with a loan from the European Investment Bank (EIB), Georgia
- Design of Northern Water Purification Plant, Warsaw-Wieliszew, 260,000 m³/day, Poland
- Design and construction supervision of Czajka Wastewater Treatment Plant serving approx. 2.1 million inhabitants, 430,000 m³/day; Łódź Wastewater Treatment Plant serving approx. 1 million inhabitants, 215,000 m³/day; and Katowice Wastewater Treatment Plant serving approx. 180,000 inhabitants, 40,000 m³/day, Poland
- Design of Southern Tehran Wastewater Treatment Plant; use of treated wastewater for irrigation south of Tehran, 450,000 m³/Tag, Iran
- Design of Wathba Wastewater Treatment Plant, 345,000 m³/day and of Saad Wastewater Treatment Plant, 92,000 m³/day in Abu Dhabi, United Arab Emirates
- Preparation of feasibility study, conceptual design and tender documents for the Telavi Wastewater Treatment Plant serving approx. 52,000 inhabitants and the Tskaltubo Wastewater Treatment Plant serving approx. 18,500 inhabitants, Georgia



Capability Statement Water and Environmental Engineering

- Design of Sulaibiya Wastewater Treatment and Reclamation Plant, 600,000 m³/day, treatment of wastewater from Kuwait City to service water quality; the service water produced meets the requirements of the WHO Guidelines for Drinking-Water Quality, Kuwait



ILF – Milestones (selected national projects)

- Design of Vienna Main Wastewater Treatment Plant serving approx. 4 million inhabitants, dry-weather flow: 670,000 m³/day, combined peak flow: 18 m³/s; expansion of sludge treatment facility, Vienna
- Design of Innsbruck Wastewater Treatment Plant serving approx. 400,000 inhabitants, Tyrol
- Design of Dornbirn Wastewater Treatment Plant serving approx. 285,000 inhabitants, Vorarlberg
- Design of Achenal–Inntal–Zillertal Wastewater Treatment Plant serving approx. 225,000 inhabitants, Tyrol
- Design of Marchtrenk Wastewater Treatment Plant serving approx. 160,000 inhabitants, Upper Austria
- Design of Salzach–Pongau Wastewater Treatment Plant serving approx. 125,000 inhabitants, Salzburg
- Design of Leibnitz Wastewater Treatment Plant serving approx. 100,000 inhabitants, Styria
- Performance of pipe network analyses for Innsbruck and Imst and design of Bergisel, Griessau and Thaur-Mure water supply systems, of water transmission system in the lower Inn valley, of Hall–Innsbruck emergency water supply and of water supply and wastewater disposal systems for the ski areas on the Ötztal glacier and the Pitztal glacier, Tyrol
- Performance of pipe network analyses for Salzburg and Hallein as well as design of Taugl well field and of Golling water transmission system, Salzburg
- Development of a master plan for the supply of potable water for the province of Vorarlberg as well as design of water supply systems for the communities of Mäder and Lochau, Vorarlberg
- Preparation of well water supply concepts for the community of St. Kanzian, Carinthia
- Design of sewer systems for the communities of Wattens and Reutte as well as expansion of the sewer system for the city of Innsbruck, Tyrol
- Design of sewer systems for the communities of Dornbirn, Mäder, Hittisau, Silvretta-Montafon, Bezau, Hohenems and Feldkirch as well as creation of a public sewer database for the city of Bregenz, Vorarlberg



3 ILF – SERVICES

Water resource development and Water transmission, storage and distribution

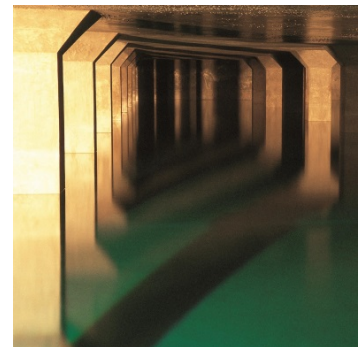
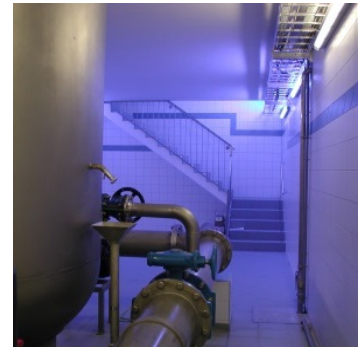
Water resource development

The challenges involved in the development of water resources may vary greatly, depending on the local conditions encountered. In mountainous terrain it is mainly springs that may easily be captured, while in valleys and lower lying areas, it is often groundwater that may successfully be tapped using individual wells or entire well fields.

In areas which have neither springs nor groundwater of sufficient quality and quantity, surface water from rivers, lakes, or reservoirs, may offer the appropriate solution.

ILF Services:

- Hydrogeological und hydrological studies
- Groundwater exploration
- Numerical groundwater modelling
- Design of spring, well, river and lake water intake structures
- Design of water treatment plants
- Management of resources
- Definition and establishment of groundwater protection zones
- Environmental impact analyses

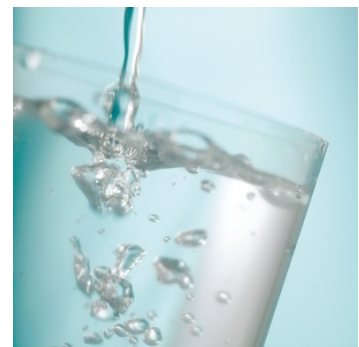


Water transmission and storage

Similar to the challenges involved in the development of water resources, those involved in the transmission and storage of water may vary considerably, depending on the local conditions encountered. It is essential to make optimum use of the geodetic difference in elevation, to ensure the technical feasibility of the project and to carefully select suitable and sustainable systems.

ILF Services:

- Design services ranging from conceptual studies to as-built drawings
- Steady-state and transient hydraulic analyses
- Comparison of alternatives and optimisation of solutions
- Consultancy services related to property and right-of-way acquisition
- Environmental impact analyses



Water supply

When distributing water to consumers, it is essential that the water made available be of the required quantity, adequate quality and sufficient pressure. Existing drinking water systems are frequently subject to high water losses. Alleviating this problem is key to ensuring a continuous and sustainable water supply.

Rehabilitating aging infrastructure is also decisive when expanding or retrofitting existing water distribution systems. Based on extensive as-built data and leak detection surveys, a hydrodynamic network analysis is performed by ILF. The objective of this analysis is to increase the capacity of the existing system by rehabilitating and optimising the network to subsequently expand the distribution network at minimum construction and operating costs.

In order to pinpoint potential problems early on in the design phase and to prevent any possible damage and extensive repair costs caused by pressure surges, analyses by means of computer-aided hydraulic simulation are performed to identify transient flow conditions in the distribution network. These analyses also include optimising various pressure zones in the distribution network under varying operating conditions.

ILF Services:

- Water demand analysis and prognosis
- Survey of current network situation and evaluation of structural integrity
- Water consumption analysis
- Flow rate and pressure measurements
- Preparation of water balances and identification of technical and non-technical losses
- Development of rehabilitation concepts
- Optimisation of network design and operation following careful hydraulic analyses
- Assistance with preparation of water supply guidelines
- Analysis of invoice data derived from water rate surveys
- Water tariff studies and calculations
- System optimisation to ensure integrated operation of water resource development, water transmission, storage and distribution
- Assistance with measures for preventive maintenance and leakage loss minimisation



Wastewater disposal

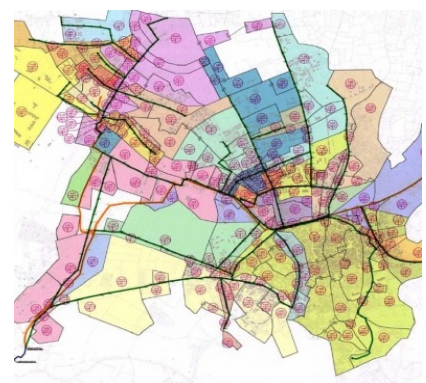
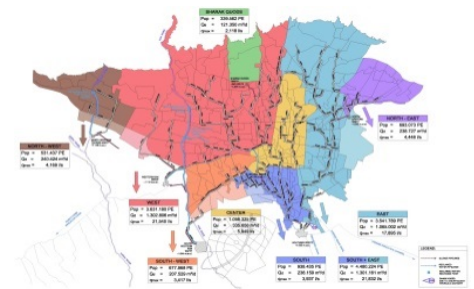
ILF has long-standing project experience in designing both combined and separate sewer systems. In addition to designing new systems, ILF’s engineering services also comprise upgrading and rehabilitating existing systems with the aim of integrating available system components to the best possible extent.

By using dynamic precipitation and drainage simulation models, capacities of existing sewer networks can be identified and effectively integrated into a holistic drainage and flood alleviation scheme. These models also serve to demonstrate and quantify sewer surcharge frequencies and their impact on the environment.

ILF Services:

- Survey and prognosis of wastewater generation volume
- Determination of catchment area parameters
- Infrastructure inventories and condition surveys
- Computer-aided manhole surveys
- Hydrodynamic network analyses
- Preparation of rehabilitation and network expansion concepts
- Preparation of relief concepts for combined sewer systems, including pollution load simulations
- Detailed design for sewers, relief and retention facilities
- Design of wastewater pumping stations

ILF uses hydrodynamic network analyses to monitor the continuous (actual) behaviour of wastewater disposal systems over extended periods of time. We simulate decisive load cases, identify weak points in the system and develop bespoke solutions for our clients.



**Wastewater treatment –
Technical and economic engineering**

Wastewater disposal and wastewater treatment facilities form a functional unit and require a holistic design strategy. ILF has decades of design experience in both sectors and is therefore in a position to develop optimised system solutions from a technical and economical point of view. Developing tailored integrated solutions for different boundary conditions is our top priority. This could be the rehabilitation of existing systems or the design of new systems. When particularly stringent requirements are stipulated by authorities, special process engineering technologies may have to be developed and implemented.



When treating sludge produced during wastewater treatment, great importance is also to be attached to selecting and/or developing technically and economically sound solutions.

ILF Services:

- Studies of alternatives including financial modelling
- Permit application procedures
- Process engineering including process optimisation
- Hydraulic design
- Layout design of treatment stages
- Design of plants and buildings, including structural design
- Design of mechanical and electrical plant equipment and of control systems
- Cost estimates for investment and operation
- Supervision of construction, installation, testing and commissioning
- Consultancy services for plant operation and maintenance
- Optimisation of energy and chemicals consumption
- Personnel training



Wastewater treatment – Energy-efficiency optimisation

Wastewater treatment, as generally practiced today, is an energy-intensive process. The main portion (approx. 60%) of the electrical energy consumed by wastewater treatment plants is needed to provide the activated sludge bacteria with oxygen. The remaining portion is needed to operate pumps and mixers as well as other mechanical, electrical, instrumentation, control and automation (MEICA) devices.

Regardless of the treatment plant capacity and the process selection, most treatment plants still need more than 0.4 kWh of electrical energy per m³ of treated wastewater. Frequently this energy demand is covered by additional energy sources such as fossil fuel in order to provide thermal energy for on-site heating processes and hot-water needs.

In a medium-sized wastewater treatment plant with daily wastewater loads of 100,000 m³/day and electricity costs of 0.15 Euros/kWh, the costs for electric energy total 2.2 million Euros per year. If a wastewater treatment plant can be made energy self-sufficient, this amount can be saved.

The net energy demand of a wastewater treatment plant is defined as the difference between the energy required for wastewater treatment and the energy produced in the treatment plant (e.g. by using the biogas generated in a combined heat and power plant). In order to minimise the net energy demand of a wastewater treatment plant, the energy efficiency and the energy recovery have to be maximised. In pursuing this objective, it is important to ensure that the effluent quality and the sludge quality are in compliance with the respective legal provisions.

As an engineering company and leading expert in designing complex wastewater infrastructure projects, we have the professional competence to work in partnership with our clients supporting them in every step towards energy-neutral wastewater treatment.

As general planner for the project “EOS - Energy Optimisation through Sludge Treatment” ILF is currently assisting the Vienna Main Wastewater Treatment Plant on its way to energy-neutral operation.

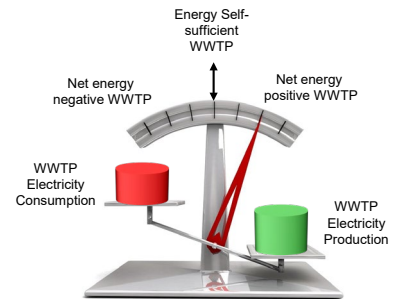
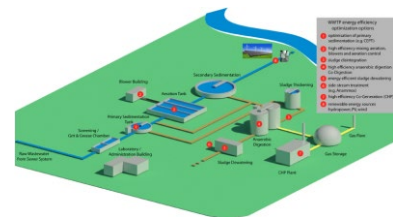


Figure showing the energy efficiency of wastewater treatment plants. On the left, the energy consumed and on the right the energy produced during wastewater treatment. In this case the amount of energy produced exceeds the amount of energy consumed, which signifies a positive energy balance.



parameter	unit	current value	target value	status
specific total electric energy consumption of WWTP	kWh/m ³	0.45	0.25	not met
specific electric energy consumption of aeration system	kWh/m ³	0.35	0.20	not met
specific sludge production	kg SS/m ³	1.5	1.0	not met
efficiency of electricity production from biogas	%	30.0%	40.0%	not met
electricity self-supply rate	%	40.0%	60.0%	not met
specific external heat consumption	kWh/m ³	0.10	0.05	not met

Illustration showing an ILF Energy Check including analyses of various specific parameters and key figures, which allow measures to be implemented in a demand- and target-oriented way.

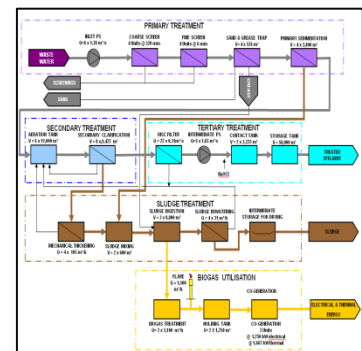
Industrial water treatment

In industry, water is used in many different processes. A consistent water quality is often decisive for stable production conditions and for consistent product quality. When water is withdrawn from the industrial cycle, it has to be treated to meet environmental standards.

The requirements for the treatment of process water and also wastewater have a considerable impact on the production costs in many industrial plants. In addition to financing and operating costs, simple handling, great reliability and a long service life are of decisive importance for our clients.

ILF offers its clients a wide spectrum of solutions:

- Water treatment
 - Treatment of raw water to provide water for industrial use
 - e.g. precipitation – flocculation – filtration
 - desalination, disinfection, etc.
 - Treatment of industrial water to provide process water
 - softening
 - demineralisation
 - iron and manganese removal, etc.
 - oil and grease removal
- Water reuse and closed-loop cycles
 - Use of suitable process wastewater for washing and rinsing purposes
 - Demand-specific water reclamation, e.g. from rinse water, boiler feedwater, etc.
 - Resource recovery e.g. from wastewater streams
 - Reuse of process water – “close the loop”
- Optimisation of on-site water cycles
 - Optimisation of existing on-site water treatment facilities
 - Adaptation of intermediate storage and distribution logistics (e.g. acid and alkaline wastewater streams)
 - Treatment of individual wastewater streams
 - Multiple use of water to conserve resources
- Wastewater treatment and residue disposal
 - Removal of pollutants
 - Use or disposal of by-products from wastewater treatment
 - Treatment of highly saline water
 - Zero Liquid Discharge (ZLD)



4 CONTACT & REFERENCES

Contact persons

ILF will be pleased to assist you with your projects and challenges.

For further information please contact our team of experts for water and environmental engineering projects.

Head of Water and Environmental Engineering Department
Contact person for water resource development,
water storage and distribution:

Werner Redtenbacher

ILF Consulting Engineers Austria GmbH
Feldkreuzstraße 3
6063 Rum bei Innsbruck
Österreich

Phone: +43 (512) 24 12 - 5197

Fax: +43 (512) 24 12 - 5900

E-Mail: werner.redtenbacher@ilf.com

www.ilf.com

Contact person for municipal water & wastewater treatment and
energy-efficiency optimisation:

Wolfgang van Appeldorn

ILF Consulting Engineers Austria GmbH
Feldkreuzstraße 3
6063 Rum bei Innsbruck
Österreich

Phone: +43 (512) 24 12 - 5208

Fax: +43 (512) 24 12 - 5900

E-Mail: wolfgang.vanappeldorn@ilf.com

www.ilf.com

Contact person for industrial water treatment:

Wolfgang Fischer

ILF Consulting Engineers Austria GmbH
Feldkreuzstraße 3
6063 Rum bei Innsbruck
Österreich

Phone: +43 (512) 24 12 - 5552

Fax: +43 (512) 24 12 - 5900

E-Mail: wolfgang.fischer@ilf.com

www.ilf.com



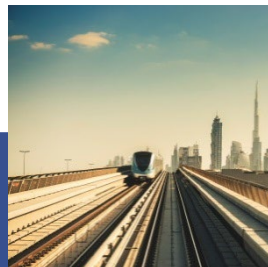
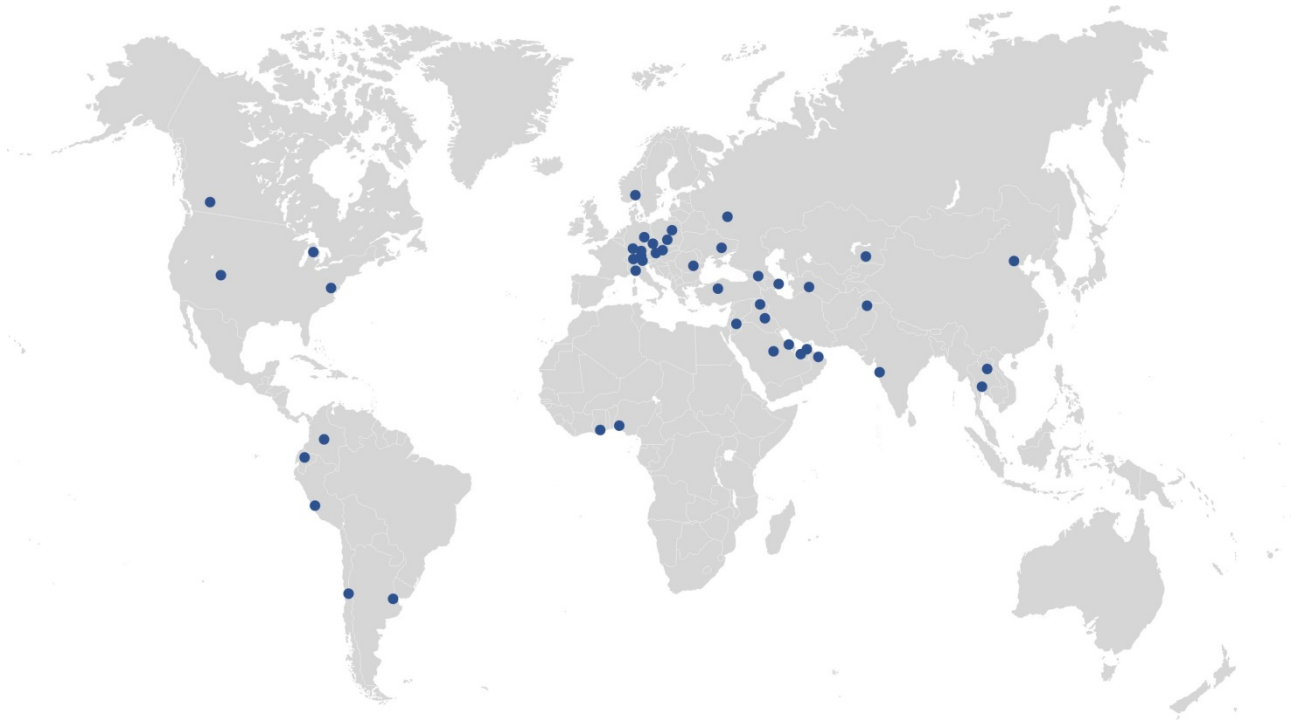
Werner Redtenbacher



Wolfgang van Appeldorn



Wolfgang Fischer



www.ilf.com

