

## **Executive Summary: Research on the Recovery of Nitrogen and Phosphorus from Wastewater Treatment Processes**

*This summary was produced to give the salient points from the in-depth reports by Ing. Marco Cremona, (Sustech Consulting, Malta) and Dr. Simon Judd, (Judd Water and Wastewater Consultants, UK) which contain sensitive data.*

### **Introduction**

This report evaluates the technical and economic feasibility of recovering nitrogen (N) and phosphorus (P) from sludge generated at Malta's three urban wastewater treatment plants (UWWTPs) – Malta South (MS), Malta North (MN) and Gozo. It identifies commercially available nutrient recovery technologies, assesses their suitability for the Maltese context, and estimates potential recovery rates, costs and operational implications.

### **Key Findings**

#### **Nitrogen Recovery**

- Recovery of nitrogen in the form of nitrate is considered neither technically nor economically viable due to the difficulty of extraction and the high costs compared with the value of the recovered product.
- At Gozo and Malta North, most nitrogen occurs as nitrate, effectively ruling out practical nitrogen recovery.
- Malta South contains ammonia-rich sludge return liquors, making ammonia recovery theoretically possible through steam stripping technologies.
- However, the relatively small ammonia load at Malta South, combined with high capital and energy requirements, means ammonia recovery is unlikely to be economically viable.

#### **Phosphorus Recovery**

- Phosphorus recovery is technically feasible using struvite precipitation technologies, particularly Ostara Pearl and MagPrex.
- Ostara Pearl is the most mature phosphorus recovery technology and produces a marketable fertiliser product (Crystal Green).
- MagPrex is primarily used to reduce struvite scaling and improve sludge management, with phosphorus recovery being a secondary benefit.

- Economic viability is strongly dependent on plant size and phosphorus load, with facilities below approximately 20 MLD generally not considered cost-effective for dedicated phosphorus recovery systems.

#### Nutrient Recovery Potential by Site

| Site        | Nitrogen Recovery                            | Phosphorus Recovery                            | Overall Assessment |
|-------------|----------------------------------------------|------------------------------------------------|--------------------|
| Gozo        | Not viable                                   | Technically feasible but uneconomic            | Not recommended    |
| Malta North | Not viable                                   | Technically feasible but uneconomic            | Not recommended    |
| Malta South | Technically possible but unlikely economical | Potentially feasible and close to cost-neutral | Most suitable site |

#### Malta South – Preferred Option

The report identifies Malta South as the only UWWTP with sufficient scale to support nutrient recovery. The preferred recovery pathway is phosphorus recovery through struvite precipitation technologies such as Ostara Pearl.

Estimated performance includes:

- Approximately 66 kg phosphorus recovered per day.
- Approximately 523 kg struvite produced per day.
- Estimated capital cost of €3.3–3.9 million.
- Estimated net operational cost of approximately €0.19 million per year.

The report concludes that phosphorus recovery at Malta South could be close to cost-neutral when reduced chemical consumption, lower maintenance requirements and improved sludge management are considered.

## **Key Constraint**

A major limitation is that Malta South currently relies on the Densadeg process with chemical phosphorus removal (CPR). Effective phosphorus recovery technologies require Enhanced Biological Phosphorus Removal (EBPR), which produces bioavailable phosphate suitable for recovery as struvite.

As a result:

- Nutrient recovery cannot be effectively integrated into the current Malta South treatment configuration.
- Significant process modifications would be required, including conversion from CPR to an EBPR-based system.

## **Recommendations**

1. Do not pursue nitrogen recovery at any of the three UWWTPs, as current technologies are not economically viable under Maltese conditions.
2. Focus future nutrient recovery investigations on Malta South, where sufficient sludge volumes exist to support recovery technologies.
3. Consider phosphorus recovery using struvite precipitation technologies, particularly Ostara Pearl, as the most mature and commercially proven option.
4. Assess the feasibility of upgrading Malta South to an EBPR-based process, as phosphorus recovery is largely dependent on this prerequisite.
5. Explore centralised sludge management approaches, whereby sludge from Gozo and Malta North could potentially be transferred to Malta South for treatment and resource recovery, if future economic assessments support this option.

## **Conclusion**

The study concludes that nutrient recovery opportunities in Malta are limited by plant scale and existing treatment configurations. Nitrogen recovery is not considered viable at any site. Phosphorus recovery represents the most promising opportunity, but only at Malta South and only if significant process modifications are undertaken to enable EBPR. Under current conditions, phosphorus recovery at Malta South is the only option that could potentially approach economic viability.