The Benefits of SIIOP

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WaPUG Scotland Meeting, June 2002

Introduction

In 1998 the former East of Scotland Water (ESW), with assistance from MWH, developed a new procedure for the development of Drainage Area Studies (DAS). This was titled 'Sewerage Infrastructure, Investment and Operation Planning' (SIIOP).

The title was chosen to reflect two fundamental business drivers – Capital Expenditure (CAPEX) and Operational Expenditure (OPEX). Both were to be covered in equal weight. The process was described by a number of specifications. These specifications were developed to take into account developments in sewerage planning that had altered the potential of a DAS type procedure to provide information.

This paper describes the benefits of this procedure in relation to a normal DAS and makes specific reference to the Hyder Consulting Ltd (HCL) Peebles SIIOP Study.

HCL was one of a number of consultants commissioned by ESW to undertake DAS's to the SIIOP specification. After undertaking several studies HCL were asked to prepare a report indicating the benefits of the SIIOP Process. The report was based primarily on the Peebles SIIOP Study, however experiences from other SIIOP studies completed were also considered.

SIIOP Objectives

The objectives of the SIIOP process could be described as:

- Use of common prioritisation across the entire region to ensure that studies were carried out in areas where the CAPEX and OPEX expenditure warranted it;
- Provide an understanding of the sewerage network with audited hydraulic models;
- Identify catchment deficiencies caused by/causing non compliance with levels of service;
- Provide value engineered solutions to agreed deficiencies;
- Provide corporate access to asset and performance data;
- Improved estimates of capital and operational spend and development of the capital programme in an effective manner;
- Detailed information on the performance of the sewer system.

A SIIOP DAS, which includes the reports and hydraulic model is treated as an asset itself, each making up a small piece of the larger ESW wide DAS jigsaw.

SIIOP Activities

The main activities of the SIIOP process could be described as:

- Data collection / hydraulic model build and verification;
- Needs analysis;

- Solution development;
- Value management workshops;
- Auditing;
- Reporting.

Peebles Drainage Area Study

In 1999 HCL were appointed to carry out the detailed design and site supervision of the Peebles Sewerage Scheme. A DAS completed in 1995 was used to compile the preferred solution. However, following a review, shortcomings were noted with the hydraulic model. HCL produced an audit report, which recommended that the study be repeated. ESW agreed with the recommendations and instructed HCL to carry out a DAS to the SIIOP specification.

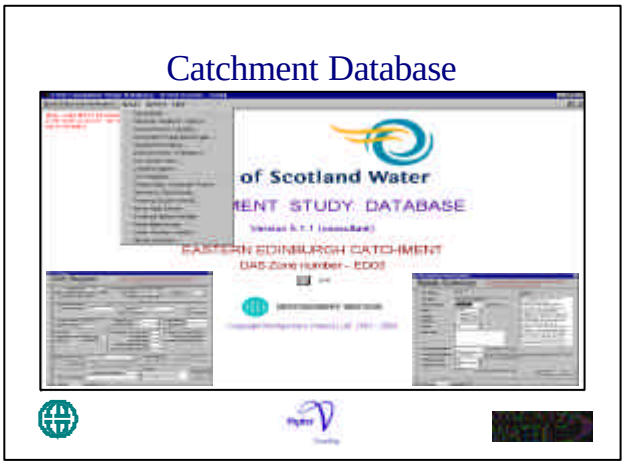
It should be noted that the 1995 study preceded the introduction of the SIIOP procedures and specification. Hence comparisons made between the studies will highlight specification differences. This paper serves to demonstrate the advances in Drainage Area Planning resulting from the introduction of the SIIOP process and is not intended as a criticism of the work undertaken for the original study.

Data Collection Stage

This stage is critical to a DAS and to the overall understanding of the sewer network. Poor data collection will make the model build and verification stage very difficult and may subsequently affect the quality of the model produced. The quality/accuracy of the needs and option assessment phases will be compromised, ultimately affecting the effectiveness of the ESW business. In addition, SIIOP integrates the study with the wider application of a data management tool. This compiles the catchment data, collated during the data collection surveys, in a consistent format so that it can be readily accessed in the future, not only for model upgrades, but for example, by operations staff charged with managing the network, overflows, pumping stations and other ancillaries.

The HCL brief for the Peebles Sewerage Scheme involved reviewing the existing model. This was very time consuming because of the lack of data collection evidence and documentation stating the processes followed and assumptions made. No drawings were available to check / confirm data included in the model. Also, the original DAS submission did not include the verified model, only the solution model with the rain gauge allocation removed. Therefore an assessment of the verification achieved was unable to be performed.

Completion of the SIIOP 'Catchment database' for the model build, needs and options stages ensures that all the relevant data collected during the study is recorded. When the database is complete the information is available for viewing by all the Authority's staff and any other interested parties, for example, the detailed designers for the preferred catchment solutions.



The collation of the data in one common location combats the historic problems associated with the possession of numerous formats of data in different locations, which also has a habit of going missing. In the future periodic updates of models/databases will provide an excellent tool for immediate analysis of system amendments, for example, developer enquiries. The combined data source is a valuable asset to ESW, however completing the database is time consuming and attracts additional costs. It also extends the overall DAS programme, which can provide conflicts with scheme delivery to meet regulator deadlines. Due to the nature of the information required for manual entry into the database it also diverts specialist modellers/engineers onto repetitive, monotonous tasks, which can prove demoralising.

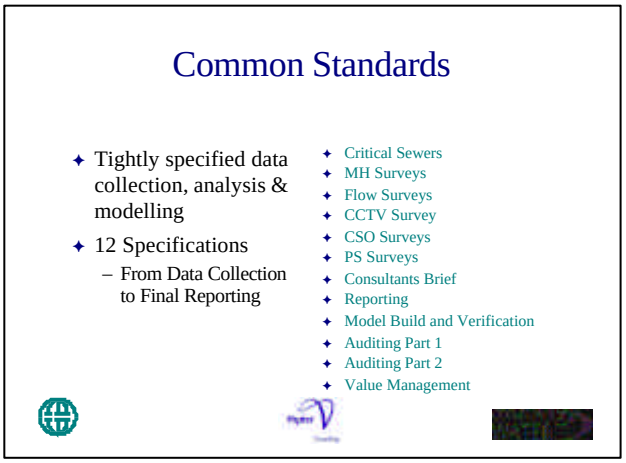
Model Build and Verification Stage

Although an experienced DAS consultant should be able to construct and verify a hydraulic model to a high standard, SIIOP includes a section that specifies the main processes to be considered. There is a comprehensive audit checklist, which acts as an aide memoir and ensures that each step is undertaken and none overlooked.

The original DAS report does not refer to several key issues on the SIIOP checklist, for example:

- consented trade discharges;
- additional dry weather flow sources, for example, hotels – Peebles Hydro can sleep up to 400;
- storage compensation;
- sewer condition and silt; and
- slow response runoff.

It was not clear from the original report why significant widespread surface flooding was observed at nodes during the verification events, when no historic flooding reports were referred to in the report and insufficient rainfall was recorded to make the overflows operate. This introduced uncertainty regarding the configuration and operation of the overflows and the sewer network data. The use of appropriate storage compensation techniques, a requirement of SIIOP, would have prevented the flooding, which was possibly due to over simplification in core areas of the network.



The final SIIOP verification stage is against historical sewage flooding locations. This is further confirmation that the model is behaving as per the sewerage system during higher return period rainfall. ESW provided HCL with reliable data regarding flooding in five locations which was not mentioned in the previous DAS report.

SIIOP ensures that the whole DAS process is documented, aided by information stored in the catchment database and geographically within the MapInfo software drawings. It provides an auditable trail to allow for independent checking and for future users' reference.

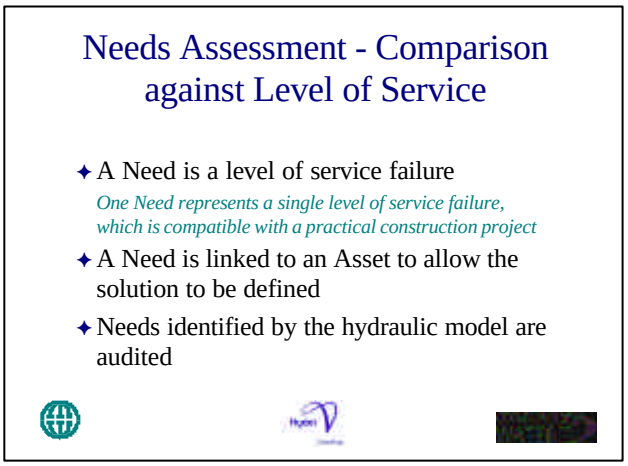
The text reporting template is structured to ensure all the relevant issues are included. Judgements and subjective decisions are an integral part of this stage of the study, therefore they should always be detailed. This is especially important when non-compliant areas of the model are identified and warnings are required to make any future users aware of the shortcomings. It should also provide

information about the additional work required to raise the standard.

Needs Identification Stage

This SIIOP stage requires the identification of the catchment needs. A clear understanding of the cause and effect relationships is essential. For example, the effect may be a reported problem with the water quality of a receiving watercourse but the cause may not be so clear. It may be a Combined Sewer Overflow (CSO) or perhaps flooding from a manhole which enters the river via a surface water sewer.

At the Needs Presentation, stakeholders agree which needs are to be addressed during the optioneering stage. It provides a useful forum for staff to recall past flooding incidents or other problems. Scottish Environmental Protection Agency (SEPA) are also invited, which provides an understanding of their requirements prior to solution development.



Four stages of analysis are undertaken:

- hydraulic;
- direct environmental impact;
- structural; and
- operational.

The original DAS considered each stage in a 'Statement of problems and needs', however the needs were not clearly defined. For example, the report does not mention the three unsatisfactory CSOs in Peebles. The original DAS report makes a general statement that 'ESW are seeking to manage the overflow spills by providing more capacity within the catchment'. From HCL communications with SEPA, they were keen to completely abandon the unsatisfactory overflows at their current locations, due to public complaints and visible debris in the watercourse, and locate them in a lower amenity area. They revealed that no water quality problems were associated with the River Tweed and that adequate dilution existed, indicating that the provision of additional storage in the system was not required.

The Needs stage provides a structured means for revealing all the problems in the catchment and a forum to discuss and agree which require attention in the next stage.

Optioneering and Value Management Stage

Solutions are considered for hydraulic, environmental, structural and operational needs identified in the previous stage. The constraints of the urban setting in Peebles, the high amenity status of the local watercourses and inter linked flooding incidents lead to integrated options in both studies.

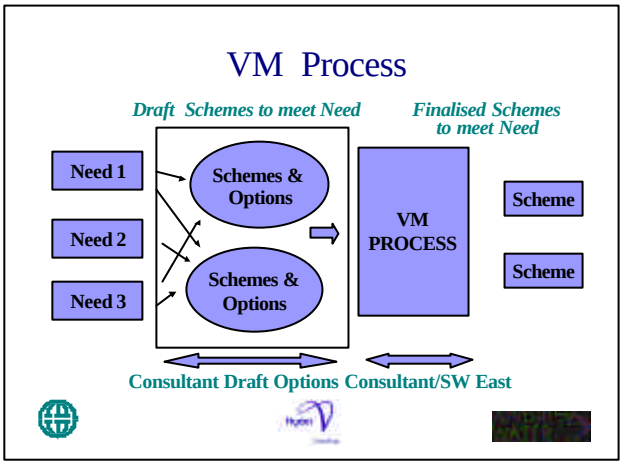
The original study report used 1½ pages to outline the whole optioneering process, which is insufficient when compared to the requirements of the SIIOP Value Management (VM) report template. In addition the information was not presented in a structured manner, making it difficult to understand what had been considered and what had not. It should however be noted that abbreviated reports were common for work undertaken in the past few years. Commercial pressures related to competitively tendered work lead to consultants producing more succinct reports, whilst still complying with client requirements. Also, in the past the lack of detailed client specifications lead to a preference for consultants to concentrate on study conclusions rather than the underlying details,

leading to insufficient supporting information being past on to the client at the end of the commission.

The VM template requires a detailed coverage of each option considered and reasons why some were discounted. This saves wasting time considering the same options at the outline design stage. The original DAS report contains one drawing showing the proposed route of the integrated option. For someone with catchment knowledge it would provoke an endless list of questions not covered in the report.

Although not identified as a need, a solution was devised for the uCSO in the south of the catchment in the original report. Prior to and during the SIIOP Needs Presentation, SEPA confirmed their expectations for this overflow. HCL dismissed the original solution during the optioneering stage because it did not meet the SEPA requirements, which was the abandonment of the CSO. Similar options were considered which included upsizing sewers under the River Tweed and upgrading the pumping station at Tweed Green, but were dismissed due to their high cost. Clearer original needs identification would have indicated that the preferred solution of simply replacing the pumps at the pumping station, to pass more flow forward would not have been sufficient. The SIIOP Operational needs analysis confirmed that the station was over 65 years old, in a very poor state of repair, subject to high operational costs and a health and safety hazard.

The VM meeting allows all stakeholders to discuss the options prepared by the consultant. The SIIOP process introduces the first stage of VM after initial optioneering has occurred. Stakeholder representatives from ESW, SEPA and HCL met with the overall objective of seeking out the optimum balance between function, cost, time and quality of the solution and ultimately achieve best value for money for ESW.



SEPA being present ensures that they are aware of the preferred solutions at an early stage and can make everyone aware of their requirements. The SIIOP VM and Options reports ensure that the benefits of each scheme, including environmental aspects, are documented. This includes highlighting the additional benefits provided by the solutions after addressing the primary needs. By not having specific sections within their report the benefits of the proposed scheme by the original DAS consultant are lost within their recommendations text.

ESW compiled a costing database, which is included as part of the SIIOP process. This Access costing database gives direct scheme costs, with NPV's for typical sewerage solutions. This allows the user to build up scheme costs from a number of separate cost models. Cost models are specifically related to sewer schemes, and use parameters which are appropriate for sewer design. NPV and construction cost mark up functions are available in the database. The build-up and allocation of costs is clear for anyone to review in the database or the reports which can be output from it.

In comparison, the original report includes one half page table with costs allocated to construction elements. Their basis is not clear, especially as the structural rehabilitation schemes total £205,000 compared to £250,000 for an item that is thought to be a 1km long tunnel. The Costing Database indicates that £1,000,000 would be a more indicative cost for a 1km long tunnel. The lack of any further evidence for the cost build up, raises concerns over the total estimated expenditure in the original DAS report, making a cost comparison between the original and the SIIOP study impossible. The costing database, used properly, provided a fully auditable trail and a consistent approach across all ESW projects.

Auditing

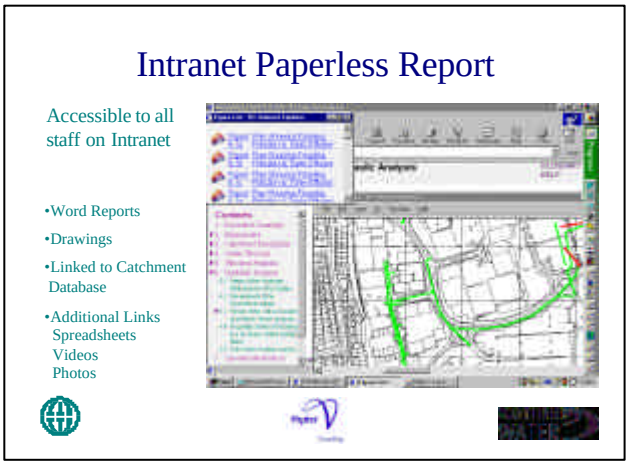
Consulting engineers were employed by ESW to provide professional services. Within HCL, rigorous internal checking procedures are employed, as with other consultants. However, as part of the SIIOP process, ESW employed the services of recognised independent specialist individuals to audit the work produced by the DAS consultants. This ensured that the consultancy services provided were of the highest quality.

SIIOP requires consultants to utilise the HydroWorks modelling software for the drainage studies. Utilising its successor InfoWorks, which provides an audit trail, would allow the auditor to trace the amendments made to the model throughout the different stages, providing cost and programme savings, in addition to reinforcing the quality of the tool.

Reporting

Reporting from the SIIOP process was considered in detail. It was decided to adopt a "Paperless" approach to the reporting because this was the approach adopted by ESW for their IT strategy. The decision to use the paperless approach was made on a business case.

The paperless report could then be provided on CD. Within the CD, each of the 4 reports were given separate folders. The 4 reports were Model Build and Verification, Needs, VM and Options. Links could then be established from the text to all specified drawings, the catchment database and any other additional files pertinent to the study. For example, these could be photographs, video footage, spreadsheets, pdf and other word files.



The benefits of a paperless reporting system are that all information relating to that catchment can be held within one source.

In order to bring the reporting methodology in line with the operational requirements, the outputs of the reports were designed from the outset to be read by operational staff. For the paperless Needs report, the traditional DAS reporting structure of structural needs, hydraulic needs, water quality needs and operational needs was modified. These basic categories were still used, but the SIIOP consultants who implemented the studies were required to identify key assets in the system. These key assets are reported on separately, and all needs and analysis relating to them are reported in one place. This allows an operational user to call an asset in the paperless report, and all relevant operational information will be found in that section.

Conclusions

A client defined DAP specification is common throughout the Water Industry to promote quality and to ensure a consistent approach. SIIOP has further demonstrated the importance of a detailed procedure, and has reinforced and built on the process adopted by other water companies throughout the UK. The comparison of the Peebles studies has highlighted the change in client reporting requirements, and also the advantages a quality driven consultants framework has over more competitive procurement strategies.

Non compliance with the specification in the early implementation stages of SIIOP demonstrated the need for the audits, but future studies carried out by experienced modelling teams may allow less rigorous checking to be adopted, providing significant cost and programme savings.

Comparing both Peebles drainage area studies has revealed several differences. The main benefits of the SIIOP process, demonstrated on the Peebles catchment are:

- a consistent approach to data collection and the construction and verification of a high quality hydraulic model of the sewerage network;
- detailed catchment asset information stored in a database for future users to access;
- clear identification of catchment needs and agreement with stakeholders, prior to solution development;
- VM meeting allows all stakeholders to discuss the options prepared by the consultant;
- an ESW appointed independent auditor reviews the consultants work to ensure high quality; and
- A paperless report containing all pertinent study information in one location.

The points noted above provide clear evidence of how the SIIOP process, coupled with the services of experienced specialist consultants introduced real value for ESW.

SIIOP combines a detailed drainage area planning specification with asset management. This is an attempt to meet study delivery targets and collate comprehensive information for catchments. DAS programmes have historically been extended for numerous reasons, and SIIOP cannot claim to have addressed the delays associated with the delivery of the overall study outputs or a reduction in the associated costs, especially with the introduction of the catchment database. However for future capital programme planning requirements and meeting future regulator targets the detailed asset database will provide the newly formed Scottish Water with a comprehensive catchment record.

The total SIIOP process has required the development of a number of tools and specifications. These tools and specifications have been used to take the DAS process further into line with the business requirements of the water companies. The specifications have sought to build on the best /most appropriate technologies, and allow new requirements to be brought into practice. The wider view of ESW assets included strict data management procedures and model build/verification processes to avoid future costs of resurvey or rebuilding models. The sum of these developments can be seen as incremental steps to developing an integrated strategy for management of information related to sewer systems.