



DELIVERING IMPROVED
WATER USE EFFICIENCY
ACROSS THE MURRAY-DARLING BASIN

Milestone Report

Development of the Irrigation Inventory Tool

November 2002



**Government
of South Australia**

Murray-Darling Basin Commission
Strategic Investigations and Education Program
I2003



Milestone 4 Report

Development of the Irrigation Inventory Tool

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INTRODUCTION

Through project I2003, the Commission, in collaboration with water management organisations and Government agencies in SA, Victoria and NSW, are working together to improve water use efficiency (WUE) across the Murray-Darling Basin.

The alliance aims to develop user-friendly, effective and affordable tools which will help regional water managers and irrigators improve water management practices, crop production and profitability and reduce environmental degradation in the horticulture sector. The tools will enable water use efficiency reporting at the on-farm, property, district and regional levels.

The prototype Irrigation Inventory Tool (IIT) is the first component of a Property and District Level WUE Toolkit. It is designed to provide systematic and consistent capture and storage of crop and irrigation information using digital orthographically corrected photographs as a basis for mapping and survey. The IIT is a geographic information systems (GIS) based tool utilising ESRI's ArcGIS Software. It has been developed to load a customised version of ESRI's ArcMap software that will provide the functionality required by surveyors. The spatial platform adopted by the IIT provides the following key benefits:

- The ability to generate spatially accurate representations of crop composition, irrigation systems, irrigation management practices, drainage system composition and drainage hazards
- The methodology for approaching this information capture in a consistent manner
- A database for housing survey information for later use in water use efficiency calculation
- A system for backup and retrieval of survey databases
- The ability to view, print and export property plans

This report outlines the stages of development undertaken in design and construction of the IIT and, drawing on the trial of the tool in the Central Irrigation Trust district of Cobdogla (Map 1), discusses recommendations for the way forward with the Irrigation Inventory Tool.

While much of the discussion in this report focuses on the trial of the IIT in Cobdogla, activities undertaken in the Merbein Irrigation District provide a view of some of the complexities of data collection the IIT has to cater for in the future.

Attachments include functional and technical specifications for the IIT as produced by Morton Blacketer, the consultants engaged to develop the software.



Map 1: Trial locations for components of I2003: Delivering Improved Water Use Efficiency across the Murray-Darling Basin

SOFTWARE DEVELOPMENT

Developer Selection

Research was conducted by staff at DEH in Adelaide to determine appropriate candidates for development of the IIT. Six reputable software development companies were selected, each being contacted with a request to provide a quote as a contractor to perform the necessary services. The companies were:

- Aspect Computing
- DMR Consulting
- Mapping and Beyond
- Morton Blacketer / ESRI
- Rokit Science
- Vectra Corp

Two submissions were received and were assessed against 15 criteria, each weighted according to its relative importance. Morton Blacketer was accepted as the successful tenderer.

The quote provided by Morton Blacketer was a significant increase on the original project and, as a result, a variation of \$40,000 was sought and approved by the steering committee and the MDBC. In retrospect, the true cost of developing such a customisation using external contractors could conceivably be much higher than has been paid. Time spent developing and resolving bugs exceeded quoted estimates considerably and this cost has been borne by the developers. It is only due to the fact that Morton Blacketer agreed to sign a fixed price contract that the cost has been kept down. Having engaged Morton Blacketer, software development began with the Scope document.

Scope

Morton Blacketer developed the Scope document, drawing on work undertaken earlier in this project by Kirk and Meldrum, 2001. The report outlines concepts involved in collection of the base information required for Annual Water Balance Index calculation and forms the basis for development of the IIT. It establishes a process by which high-resolution digital orthophotography is used as a basis for crop and irrigation system

mapping. The high level of relative accuracy of the imagery allows large scale mapping to be undertaken resulting in highly accurate areal assessments of crops.

Functional Specification

The Functional Specification (Attachment 5) for the Irrigation Inventory Tool was the first technical document developed by Morton Blacketer associated with this project. It was developed in conjunction with DEH staff via a series of meetings and electronic transfer of information. These meetings were conducted to communicate the precise needs of the proposed software customisation. The focus of the document was *what* the software should achieve. It contains descriptions of the following functional requirements:

- Logon
- Database Security
- Survey Setup
- General Information Form
- Setting The Data Source
- Crop Survey
- Water Survey
- Create Survey Database
- Database Formats
- Property Selection And Maintenance
- Crop Patch Edit
- Irrigation Patch Edit
- Data Export
- Property Plans
- Set Up

Technical Specification

The Technical Specification (Attachment 6) for the Irrigation Inventory Tool was the second technical document to be produced by Morton Blacketer associated with this project. It is structured to provide a description of *how* the software customisation should achieve the functional requirements outlined in the previous document. The Technical Specification contains sections outlining technical details of the following functions:

- Database Design
- Database Tables
- Entity-Relationship Diagram
- Logon
- Database Backups
- Database Restoration
- Survey Setup
- General Information
- Setting The Data Source
- Crop Survey
- Water Survey
- Create Survey Database
- Database Formats
- Property Selection And Maintenance
- Property Patches Verification
- Crop Patch Edit
- Editing Crop Patch Features
- Crop Patch Data Form
- Layer Display
- Irrigation Patch Edit
- Data Export
- Property Plans
- Menus And Command Item Availability
- Main Menu
- Editor Toolbar

-
- Page Layout Toolbar
 - Context Menus
 - Customisations
 - Set Up
 - Quality Assurance

Upon endorsement of the Technical Specification by Project Staff at DEH, software development was initiated.

Software Development

Sign-off on the Technical Specification occurred on 6 February 2002 with software development continuing, in various stages, until 19 June 2002.

The stages in software development included:

- Encoding of Processes and Preliminary In-House Testing

This period of development was the most lengthy, during which Morton Blacketer worked at achieving the goals outlined in the specifications. Weekly meetings were held to report on progress and resolve any technical issues that prevented objectives from being achieved in their original form. This process highlighted unforeseen problems associated with interfacing the functionality requested with the host software platform.

- End-to-End Testing

This phase of development was conducted in-house by Morton Blacketer and referenced the Test Plan. Feedback on progress was also communicated via weekly meetings.

- User Acceptance Testing (UAT)

UAT was undertaken by DEH and Central Irrigation Trust (CIT) staff at several locations which included:

- DEH offices, Adelaide
- CIT offices, Barmera
- Cobdogla Irrigation Area Irrigators residences, SA
- Morton Blacketer Offices, Parkside

This process highlighted inadequacies in Morton Blacketer's Test Plan - End-to-End Testing process. Originally, it was not planned to conduct UAT at Morton Blacketer's Offices but it became obvious that a closer working relationship was necessary

between DEH staff and the developers to achieve the goals set out for the project. The main contributing factor in this scenario was the inexperience of the developers with the ArcGIS 8.x platform, a suite of software programs which is, at this point in time very new. As a result, significant reworking of the software was undertaken at Morton Blacketer's expense.

Warranty Period

User Acceptance occurred on 6 June 2002. This initiated the 90-day warranty period, during which any conflicts between software operation and actual specification would be resolved by Morton Blacketer. The warranty period ended on 5 September 2002 with some issues still remaining. It has been agreed that these issues will be resolved under warranty as they were reported prior to its expiry.

Several issues emerged in installing the IIT in the Barmera offices of CIT which were resolved prior to 19 June 2002. Currently, Morton Blacketer are working on issues associated with the recent release of version 8.2 of ESRI's ArcGIS suite.

Test Plan

The Test Plan was the final document produced by Morton Blacketer. It outlined the procedure used by Morton Blacketer as part of their QA standards. The Test Plan was an internal document communicating to the clients the testing that occurred prior to release. While it highlighted the best of intentions, the execution of the test plan left many bugs. This was due to a combination of two key factors:

- Relative inexperience of developers with spatial software
- Relative inexperience of project staff in undertaking software customisation via contracting of developers

COBDOGLA TRIAL

Background

The Cobdogla Irrigation Trust is a pumped district in South Australia's Riverland comprising some 550 properties. Irrigation water supply and drainage is the responsibility of the Central Irrigation Trust.

Since rehabilitation of the district from open channel delivery to pressurised pipes in the 1990s, Cobdogla has been a focus of considerable research in the water resource management arena. In fact, district-wide WUE statistics exist for the 1996/7, 1997/8 and 1998/9 irrigation seasons (Kirk, Miles and Ralph, 1999). In the same period, the district has undergone considerable change with the vast majority now being planted to wine grapes.

Office

A series of office trials were conducted using the prototype IIT. Essentially, this process was designed to test the IIT and ensure that most bugs had been ironed out prior to taking the tool out in the field. In the office, the processes involved with property patch definition, crop and water data entry, and the production of property plans and data pages were tested. Several issues were discovered during these tests and were addressed by the software developer prior to the infield trials taking place.

In the Central Irrigation Trust offices in Barmera, data entry from paper surveys conducted in Cobdogla (SA) was undertaken as a part of the testing process. This identified some issues associated with transferring the data from the paper surveys to the IIT.

In-Field

In the field, several properties participated in trial surveys using the IIT. The purpose of these trials was to gauge the response of irrigators in the Cobdogla Irrigation Trust to undertaking a survey using the IIT on a laptop computer. Previously, these irrigators' properties had been surveyed using the traditional paper survey method.

Participants in the trial included several irrigators who were also participating in the Farm Level Water Management Module trial as well as others targeted for their influence within the community. The irrigators surveyed were also selected for their understanding of technological approaches to management of farm business. For example, many of them use the Internet for water ordering within Cobdogla. These irrigators are well informed about the project and have a keen interest in improving irrigation management techniques. To provide a balanced perspective to the trial two irrigators were surveyed who had no prior knowledge of the project. Overwhelmingly, irrigators who participated in this trial were very interested in the IIT and it's application.

The trials were conducted by DEH, PIRSA and CIT staff using the IIT loaded on a Compaq Laptop with the following specifications:

- Pentium III 850mhz
- 192M Ram
- 8M Video card

For the most part, the trial survey of the selected irrigators took place on the properties in question. One irrigator was surveyed in their place of work during a lunch break. The surveys took approximately 30 minutes each to complete and highlighted the efficiency of entering information directly into the database using the IIT as opposed to doubling of effort by first collecting the information on paper. The surveys were comprehensive, collecting crop information down to a rootstock level of detail and irrigation system information including scheduling methods and soil water monitoring equipment. Additionally, drainage system information and drainage hazards were mapped. Attachment 3 is the Cobdogla survey form showing the full range of information collected.

It was originally intended to conduct extensive field trials of the software in both Cobdogla and Merbein Irrigation Districts. However, problems arising during software development delayed the release of the first versions of the software. Ultimately, surveys were required to be completed prior to the tool becoming available. This resulted in only a handful of irrigators being surveyed "live" the vast majority were surveyed using the traditional paper method.

Irrigator reaction to the software was good. Generally, they were impressed by being able to view the aerial photograph of their property and were enthusiastic about ensuring that the information collected for their property was accurate. Most surveyed recognised that, besides providing valuable information for better natural resource management, they were establishing a resource, in the form of the geo-database, that would provide direct benefits to them. These benefits ranged from the ability to access accurate areal assessments of crop patches to receipt of property plans produced with the resultant data.

In the 2002/3 irrigation season it is intended to conduct further field trials of the IIT in Kingston, Ral Ral, Chaffey and Coomealla Irrigation Districts. Investigations will occur into expanding the flexibility of the tool prior to this occurring.

MERBEIN TRIAL

Background

The Merbein irrigation district is a pumped district in Victoria comprising some 350 properties. Irrigation water supply and drainage is the responsibility of the Sunraysia Rural Water Authority (SRWA).

Support for the project was obtained from SRWA in late 2001 and it was agreed to trial the Merbein district as it represented a Victorian district of comparable size to the South Australian trial district of Cobdogla.

Sixty percent of Merbein properties had been surveyed by SunRISE 21 in 1997 with regards to crop and culture details. 1996 orthophoto imagery was used to produce hard copy maps for surveys and to undertake data entry with Arcview 3.x software. For properties that had been surveyed in 1997, the 2001/2 WUE survey was an update survey rather than starting from scratch again.

Trial Objectives

The Merbein trial was undertaken to:

- Trial data collection and entry using the Irrigation Inventory Tool (IIT)
- Trial importing of existing (Arcview 3.x format) crop and water data into the IIT.

Field Survey

Merbein irrigators were notified by a joint letter - SRWA and SunRISE 21 - in November 2001 that property surveys were to be undertaken, the purpose of the surveys and anticipated benefits.

SunRISE 21 commenced field surveys in December 2001. Irrigators were first contacted by phone and given the choice of nominating an appointment time for a property visit or to drop in at the SunRISE 21 office to do the survey. Approximately a third of growers opted to drop into the SunRISE 21 office - predominantly because they required the information for the printing of 'Crop Plans' for quality assurance programs and contracts with wineries and the dried fruit industry.

Most properties were surveyed using hard copy survey maps showing 1997 crop and water details but with a back drop of orthophoto imagery derived from February 2000 aerial photography. Survey maps were of a similar layout to the Crop Plan - Attachment 2.

A copy of the survey form used is shown in Attachment 1.

A 'water outlets' data set was supplied to SunRISE 21 by Sunraysia Rural Water Authority, however, not all outlets were attributed with an outlet number. The data set enabled the location of outlets to be shown on the survey maps for growers to verify and provide outlet numbers. Approximately 10% of irrigators did not know their outlet number or were not confident of the outlet number shown on the survey map.

Surveys of Merbein properties ceased during the harvest period of February to March 2002 and recommenced April to June 2002. Approximately 60 properties were not surveyed - the property owners were either unknown or known but not contactable - thought to be due to owners residing outside the district and/or having full time jobs off the property or not wishing to participate in the survey.

Data Entry

Crop survey data was entered at a scale of 1:2,000 or better using Arcview 3.x software. The IIT was still being developed at the time and Arcview 3.x was required to facilitate the output of property Crop Plans as required by growers and industry. An Arcview 3.x script is used to produce these plans as the template contained within the IIT does not replicate the property plans currently used.

Crop data was then standardised for importing into the IIT. Look-up tables are being created to support this process.

Water data collected will be entered directly into the IIT once setup is complete.

Trial Results

No experience has yet been derived in utilising the IIT for data collection and entry as crop and water data collection and crop data entry had ceased prior to the IIT being ready for use. Trial of the IIT for water data entry and for importing of existing data

is in progress. Further opportunities to trial the IIT will be undertaken in the Coomealla, NSW trial that is now in progress.

Many Merbein growers were apprehensive about supplying crop and water data for a water use efficiency project. In particular, those using furrow irrigation were concerned about price rises and cut backs in water allocations. One grower approached was openly abusive and refused to participate in the survey.

Difficulty was experienced in defining crop patches watered by more than one outlet - especially for the scenario of furrow irrigated patches where the area watered by outlets can vary between irrigation events.

Implementation of the Privacy Act during the project has impacted on access to property ownership and contact details, water consumption data and outlet numbers per irrigator.

Permission from growers to access such details needs to be carefully written into and signed on survey forms.

The SunRISE 21 crop database has evolved since 1996 predominantly driven by industry (dried fruit, wine grape and citrus) needs for property redevelopment planning, quality assurance programs, planting statistics and crop forecasting. There are significant overlaps between base data requirements to meet these industry needs and to meet those of WUE measurement. Importing of existing data is providing an opportunity to explore overlaps, compromises and the ability of the IIT to accommodate regional and State peculiarities.

RESULTS

The full trial was restricted to Cobdogla due to the timing of the release of the software. At the time this report was produced, SunRISE 21 were yet to trial the IIT in the Merbein survey. Due to local pressures, the Merbein survey could not be delayed to wait for the IIT to be ready and the data was entered into the SunLIS using existing ArcView 3.x methodologies. While this process is not the one originally intended for the project, it provides a useful case study for the transferral of data between shapefile-based systems and the new IIT personal geodatabase infrastructure. This process will be reported on in a technical document at a later stage which will outline guidelines for transferral of existing data between available formats.

Phase One - Orthophotography

The first phase in the trial was the acquisition of the digital orthophotography that forms the basis of the survey. Orthophotography is aerial imagery which has been rectified to remove feature displacements caused by aircraft tilt at the time of exposure and/or the nature of the terrain relief. Imagery for the Cobdogla trial was flown at 1:15,000, scanned at 20 microns and ortho-rectified using coordinates gathered from a combination of airborne GPS readings and ground control points. The resultant imagery has a relative accuracy of one pixel (0.3m). As such, the imagery is accurate enough to allow digitisation of boundaries at 1:1,000, the required scale for accurate definition of valve unit boundaries under Farm Level Water Management Module methodologies.

The cost of obtaining the source imagery for the survey was \$9,700. This covered approximately 9,840 hectares, of which 3,380 was under crop. This translates to a cost per hectare under crop for imagery of \$2.86. Outside the trial area, the cost associated with acquisition of imagery would vary according to the shape of the area to be flown. If the ratio of cropped area mapped to imagery flown was increased to 1, then the cost equates to approximately \$1 per hectare. In reality, this situation would be difficult to achieve. However careful design of flight plans can reduce cost per hectare significantly.

Purchase of orthophotography is an ongoing cost, the magnitude of which will be determined by the degree of change in a district. The degree of change can be influenced by many factors that could include:

- National and International commodity prices - The degree of change is highly dependant on commodity markets and profitability of crops. If crops planted within a district are generating good returns then the likelihood of significant change is low. In this case, frequency of image acquisition would only need to be low and resurvey could be undertaken using existing imagery.
- Availability and cost of inputs and outputs - Many factors can affect availability and cost of water for irrigation. While entitlements are locked down, increasingly, pressure is being put on water use by changing climatic and political conditions. In the past, rehabilitation of irrigation districts from open channel delivery systems to pressurised pipe networks has resulted in significant water savings allowing developed areas to expand. The advent of the water entitlement market has seen water allocations redirected from less profitable uses to more intensive forms of agriculture. In the future potential trade in salt credits could see water redirected into lower impact areas.

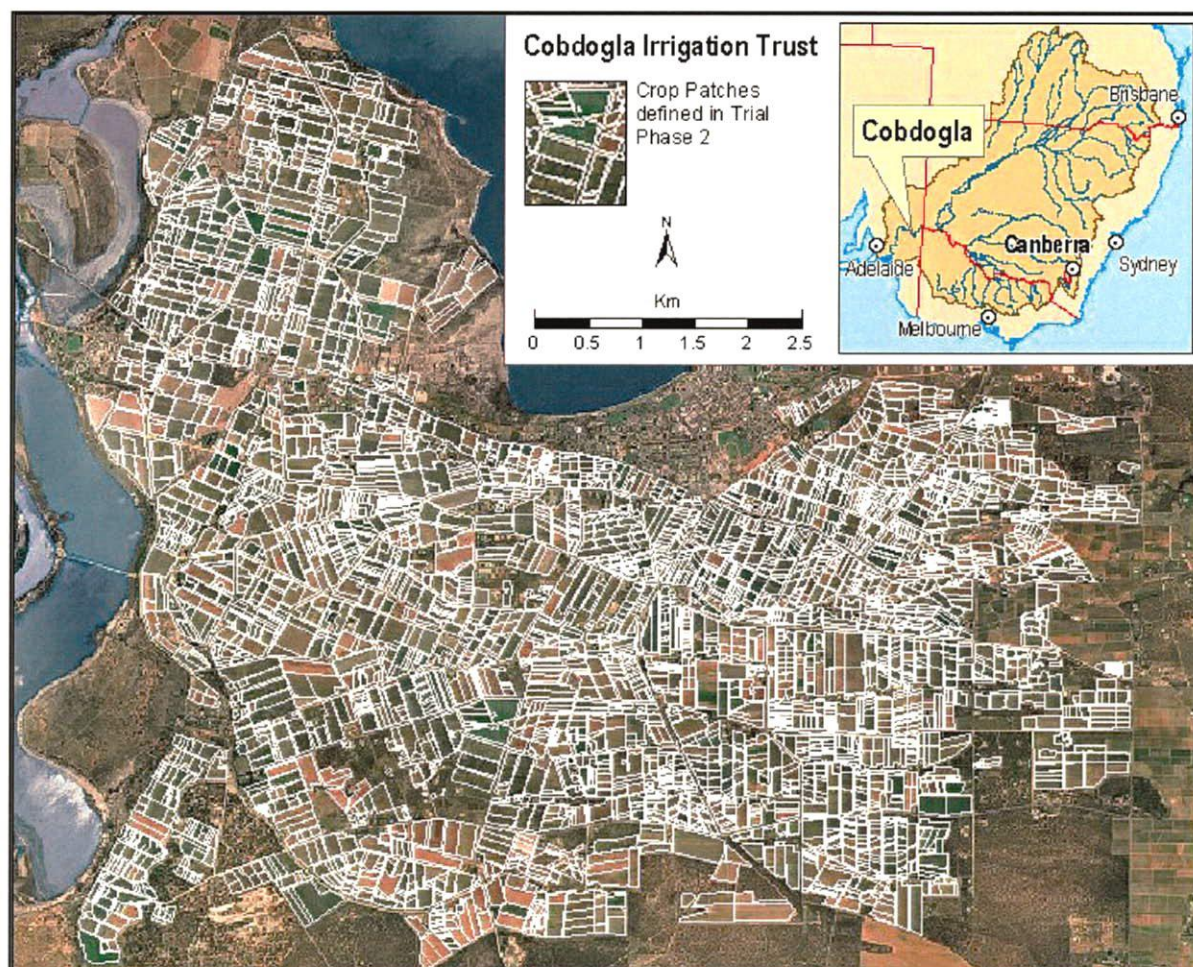
Ideally, survey coordinators should be able to develop appropriate trigger mechanisms that monitor the drivers of change in their area to assist in timing re-flying of a district.

Phase Two - Crop Boundary Identification

Crop boundary identification is a start-up expense that creates the base line-work required for use in survey. The process involves heads-up digitising of discernible visual differences in crop appearance on the digital orthophoto. For the Cobdogla trial, digitising was undertaken at scales of 1:2,000 or larger, providing accuracy ratings for mapped areas of up to ± 2 per cent.

By undertaking extensive preliminary mapping in the office, the amount of time spent in the field is greatly reduced. This reduces the time required for grower involvement in survey as a significant amount of the patch splits required for mapping to variety level can be interpreted from the photo prior to conducting a grower visit. While this is not a failsafe method of picking up crop composition, it does provide a method for increasing efficiency of survey.

Once used in survey, the completed crop composition layer provides the basis for the next survey, thus removing the need to undertake preliminary crop boundary identification in subsequent surveys. The exception to this scenario would arise if re-survey of districts is not undertaken until after significant change (over 50%) has occurred.



Map 2: Initial Crop Patch boundaries interpreted from the Cobdogla digital orthophoto in phase two of the trial.

In all, for the Cobdogla survey, 3,380 hectares (Map 2) were mapped to preliminary levels in 99 hours at a rate of 34.3 Ha/hr. This translates to a cost of between 46 and 82 cents/Ha, depending on the classification of staff member used to perform the task. This task is one that requires a basic understanding of GIS interfaces and processes and, as such, could be performed by a level 1 or 2 Technical Officer. A satisfactory outcome could be achieved with minimal supervision for around 50 cents/Ha.

Phase Three - Property Number Allocation

Property Numbers are allocated to the initial line work defined in Phase Two so that the IIT is able to distinguish between properties. The allocation of property numbers is a Start Up exercise which must be undertaken the first time a district is surveyed. In subsequent surveys, minor modifications to the property composition of a district can be carried out in the IIT on the fly. Each property within the district should be allocated a four digit number between 0001 and 9999. This number is used by the IIT to store property details in the geodatabase. The structure of the IIT geodatabase allows a related table to store all details that occur uniformly across the property in one record which is then linked via the Property ID to all patches that comprise the property. The Property ID is also used as an identifier so the IIT can zoom to the correct position on the orthophotograph when any given property is selected from the appropriate form.

In the Cobdogla Trial, Property ID definition was conducted over 3,210 hectares at a rate of 22 hectares per hour. No existing Property IDs were available for Cobdogla so, this process needed to be conducted from scratch. The cost associated with this component of the process was 95 cents per hectare but could be quite easily achieved with minimal supervision by a low skilled technical officer for around 70 cents per hectare. Automation of this process using pre-existing GIS data sets could make this a simple half-hour job, in which case, cost would be negligible.

Phase Four - Irrigator Survey

Due to delays in the release of the software, Irrigator survey was conducted almost entirely using paper forms. The original intention of this component of the Trial was to enlist Irrigators using the Internet for water ordering as candidates for trialing the IIT. This was scaled back considerably with only a handful of irrigators being surveyed "live" with the IIT on a lap top computer. The conduction of a paper based survey in the first instance of IIT use has been recognised by the project team as being beneficial. This is particularly true in the case where growers are likely to become unenthusiastic about participation when confronted by someone they do not know entering data about their property directly into a computer. With time, as acceptance of technological advance increases within the horticultural sector, the need to

undertake paper survey may disappear altogether. For the time being, at least, it is deemed an important part of the start-up phase of IIT use.

The paper survey for the Cobdogla Trial was conducted by Central Irrigation Trust field officers. In total, over 530 properties within the Cobdogla district were surveyed, a process that took 1,040 hours. This represents a significant investment in data capture as the cost associated with this varies between \$5 and \$9 per hectare.

Phase Five - Patch Definition and Survey Data Entry

In this phase, all data captured in phase four was entered into the geodatabase. It was attached to a record created in the database in phase two. These records were created from aerial photograph interpretation and, as such did not represent the true complexity of crop composition across Cobdogla. The true composition of crops and irrigation systems was captured during grower interviews onto property plans containing the base patches. As a consequence, splits to these base patches were drawn onto the orthophoto base of the property plans and transferred into the geodatabase in the survey data entry process. The survey data entry process has four main sub-phases. The first is entry of property details using the custom forms provided (Figure 1).

Upon starting data entry, the surveyor must select a property by filtering the list of the properties currently stored in the database. Once a property is selected the surveyor then enters all relevant details and proceeds to the spatial view of the property for property composition checking (Figure 2) and patch splitting/merging.

In the Property Composition Checking phase, patches can be added or removed from a property. This is done prior to crop data entry because the action of adding or removing a patch from a property resets the data record for the patch to null. In the event of transfer of patches from one property to another (eg if neighbouring properties are amalgamated after a sale), the added patches will need to be re-coded.

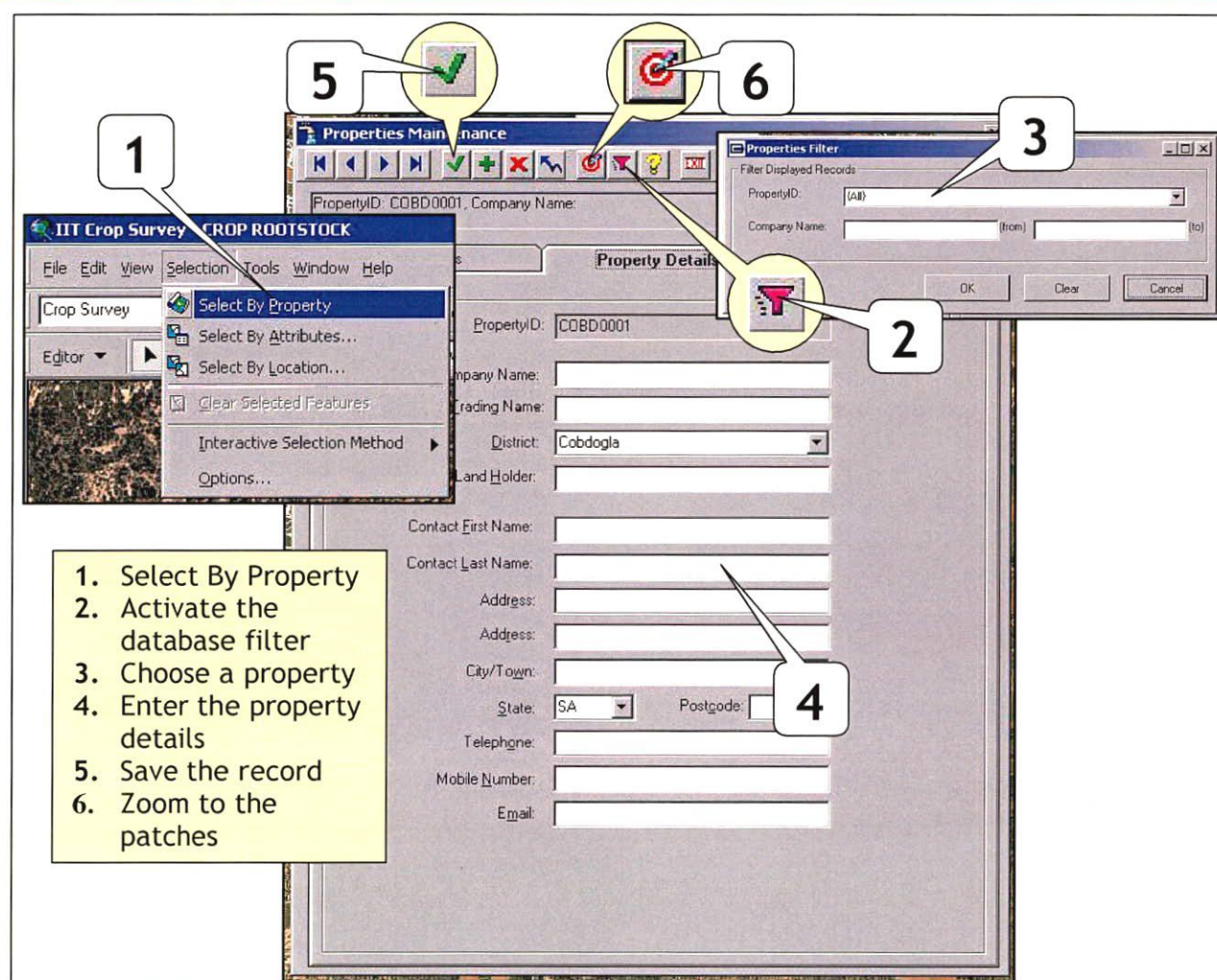


Figure 1: Property details are entered using the Property Maintenance Form and Tools.

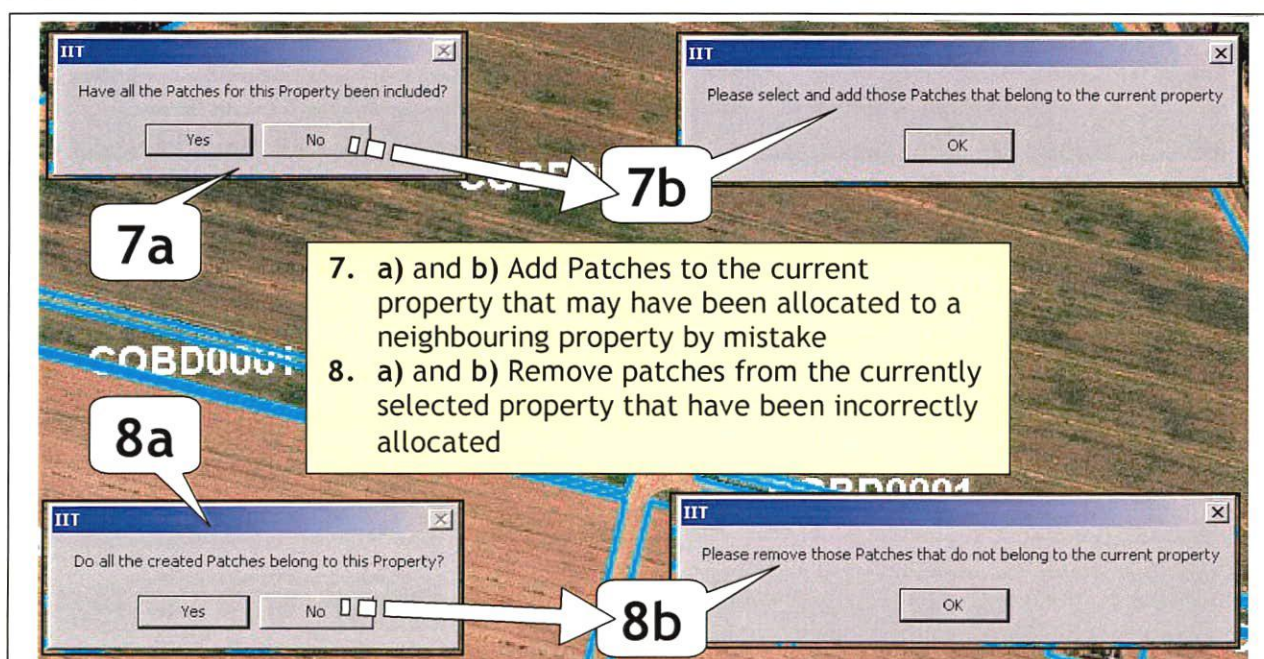


Figure 2: Property Composition is validated via a series of prompts and custom tools.

The third phase in the data entry process involves splitting and merging of patches to reflect true crop composition. Referencing the completed paper survey, field officers were able to transfer subdivisions to the base patches into the geodatabase (Figure 3.) This created new records in the database that could be used for recording information not discernible from the orthophoto such as differences in varieties, rootstocks or irrigation systems.

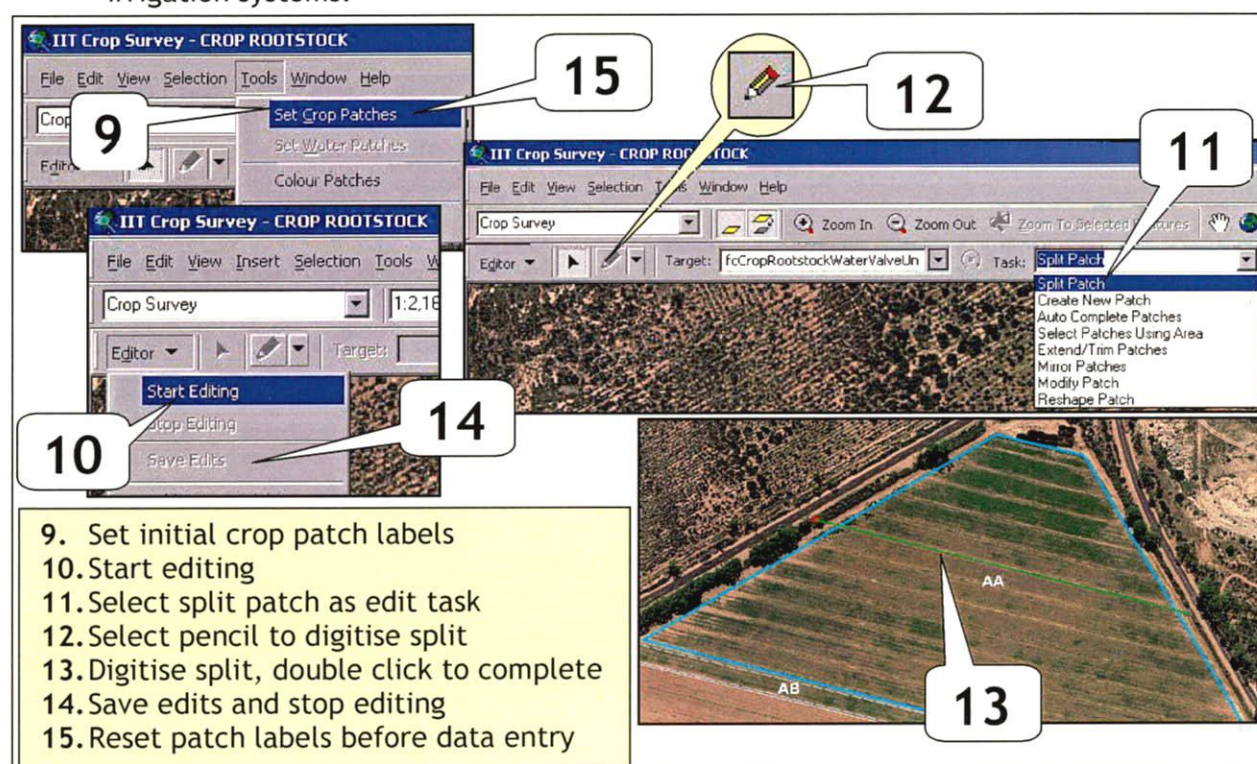


Figure 3: Splitting base patches in preparation for survey data entry.

The final phase of survey data entry was the simplest of all. It involves transfer of data recorded on the survey forms to records in the database that have been created in the previous phases. In the case of the Cobdogla trial, paper survey forms were designed as close as possible to reflect the order in which data needed to be entered into the electronic forms of the IIT (Figures 4 & 5). While some fields were not necessarily in their correct place on the form, the process generally flowed smoothly, with field officers having copies of the coded options available in the IIT picklists. The few discrepancies between the paper survey forms and the data entry process were due entirely to the fact that the paper survey commenced well before the development of the IIT had been completed.

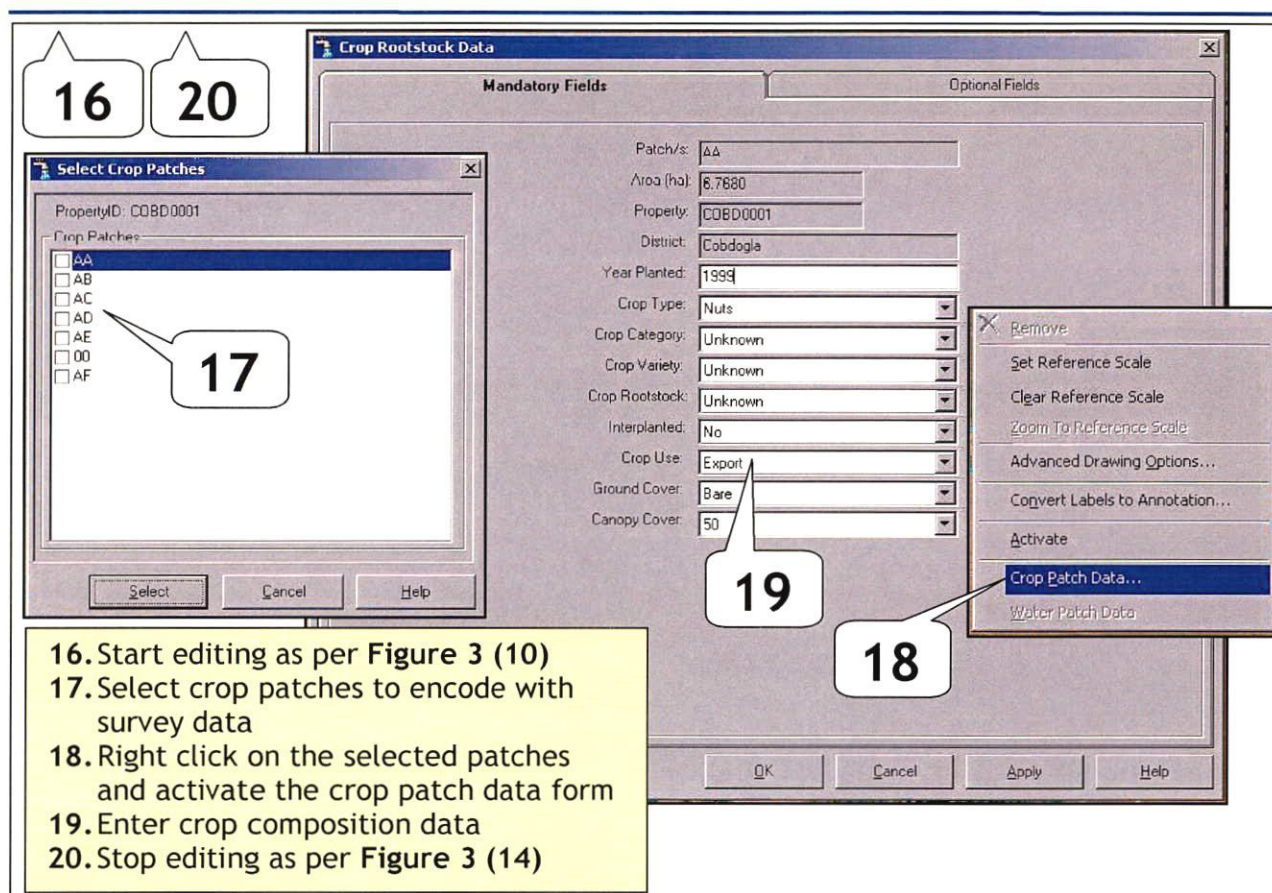


Figure 4: Crop patch data entry via custom forms

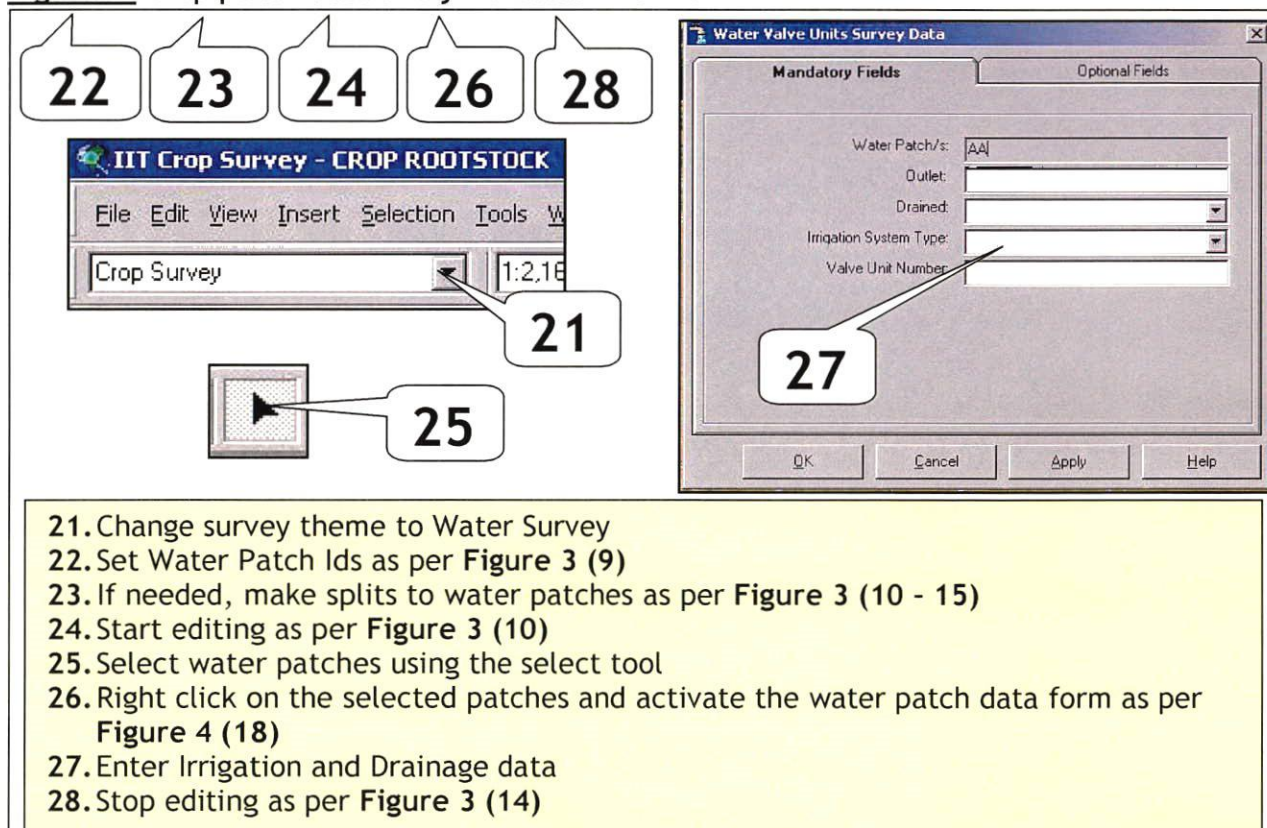


Figure 5: Water patch data entry via custom forms

The patch definition and survey data entry was still in process at the time that this report was produced. Of the 3,210 hectares of base patches mapped for Cobdogla, the survey information of 2,637 had been completely entered into the 2002 Irrigation Inventory Database at a rate of 6.26 ha/hr. This approximates the rate that could be expected should the paper survey component be completed or not. In the event that a paper survey is not conducted, the IIT provides the ability to survey direct to computer, an action that would result in significant time savings.

Table 1 summarises the results of the IIT trial in Cobdogla. The table itemises various phases of the trial process and examines the costs involved in each phase. The phases are classified as either ongoing or start up. Ongoing phases are ones that, ideally, should be undertaken each time a survey is conducted. Hence, the costs incurred in this phase are expected to be costs which will need to be budgeted for into the future. A start up phase is one that involves detailed preparation prior to undertaking the first IIT survey of a district. These are phases that will need to be undertaken only once per district.

Hourly Rate by Classification				
L1	L2	L3	L4	L5
15.91	18.32	21.11	23.69	28.29

						Cost (\$ per Ha) by Classification				
Cost	Phase	Ha	hrs	Ha/hr		L1	L2	L3	L4	L5
Ongoing	1 - Orthophotography (\$9,700)	9,839	-	-		0.99	0.99	0.99	0.99	0.99
Start up	2 - Crop Boundary ID	3,379	99	34.30		0.46	0.53	0.62	0.69	0.82
Start up	3 - Property Number Allocation	3,210	144	22.29		0.71	0.82	0.95	1.06	1.27
Start up	4 - Grower Survey (Paper)	3,210	1,040	3.09		5.15	5.94	6.84	7.67	9.16
Ongoing	5 - Patch Definition and Survey Data Entry	2,637	421	6.26		2.54	2.93	3.37	3.78	4.52
						9.86	11.20	12.76	14.19	16.76

L - Administrative Services Officer Level

Table 1: Cost breakdown for components of the Cobdogla Irrigation Trust IIT Trial

From table 1, on average, conduction of a paper survey represents 54 per cent of the total cost of survey, whereas the patch definition and data entry process, effectively duplication of the paper survey, represents only 26 per cent. Should a survey be conducted without a paper survey cost could be expected to reduce by around 28 per cent.

RECOMMENDATIONS

As a result of the office and field trials, a number of recommendations have been suggested to improve the useability and function of the IIT prototype. These recommendations have been separated into three groups; Modifications, Enhancements and Crop Survey. The first group of issues, Modifications, lists those that relate to the function of existing IIT tools and processes. The Enhancements section suggests the inclusion of additional tools and processes that would improve the overall function of the IIT. Crop Survey related recommendations are more to do with general processes and functions.

The following recommendations relate specifically to the IIT trials in Cobdogla and Merbein and it is advised that these changes are implemented for the final version of the IIT.

Recommended Modifications to the IIT

1. All items in the dropdown lists shall be in alphabetical order.
2. On the Crop Patch Data survey form on the right-hand side of the Optional tab, change the order of the items on the form to represent the order of the items on the left-hand side and on the Mandatory tab.
3. The IIT should not stop Editing after selecting Add Patches from the Editor menu. Instead, allow the user to select Save Edits then Stop Editing. Upon selection of the Stop Editing command, the IIT should re-enter the loop of questions (currently, the user is required to Start Editing > Stop Editing to re-enter the loop of questions). The same process should occur when removing patches.
4. After creating a new patch and unselecting that patch, the patch disappears. The user is then required to select Save Edits and Stop Editing, then Set Crop Patches, before the patch reappears. The user should be able to see newly created patch without having to restart editing.

Recommended Enhancements to the IIT

1. Remove the Select Crop Patches dialog box that appears when you start editing the property. This box does not appear for the Water patches.
2. In Crop Survey mode, after selecting Stop Editing, all patches become selected. Therefore, when changing to Water Survey, all patches are selected and remain selected when selecting Start Editing. It is recommended that when in Crop Survey and Stop Editing is selected, all patches should be unselected.
3. After zooming to a property and completing the loop of questions, automatically display the Crop Patch ID's rather than displaying the property IDs. This will eliminate the need to Set Crop Patches manually.
4. After coding a patch with Crop information and clicking 'OK', automatically colour the patches. The same should occur when coding with Water information (i.e. when in Water Survey mode colour the patches according to whether water data has been entered).
5. Add a function to 'uncolour' the patches after the patches have been coloured.
6. Add in the standard ESRI ArcMap 'Shared Edit' tool to edit adjoining polygons.
7. Remove the function that Stops Editing automatically after the Merge option has been selected from the Editor toolbar. Allow the user to continue merging patches until Stop Editing is selected.
8. When changing between Crop and Water surveys, automatically change the displayed Patch ID's to represent the type of survey mode (e.g. If in Crop Survey mode, display Crop Patch IDs, and if in Water Survey mode, display Water Patch IDs without having to Set Crop Patches).
9. Add the ability to turn all Optional items on a form on at once.
10. Allow the user to allocate Patch ID's to particular patches. This may involve adding a tool that can be used to click on each patch in the order the Patch IDs

wish to be added. The Patch IDs will still use the current coding system (i.e. AA, AB, AC, etc), however the user will have the ability to select which patch obtains which Patch ID. This will assist the data entry process when transferring data from the paper survey to the IIT. Investigate manual entry of all patch ids with an automated process to check for duplications upon cessation of editing.

11. After answering 'No' to either of the questions "Have all the Patches for this Property been included?" and "Do all the created Patches belong to this Property?", add the Editor Toolbar automatically.

Crop Survey

The data entry component of the IIT testing identified some issues in relation to the format of the paper survey used in the Cobdogla Irrigation Trust area. The order of the crop and water data items on the paper survey differed from that in the IIT. The survey forms have since been modified to reflect the order of data entry in the IIT. This improves the ease and efficiency at which data can be entered into the IIT.

1. The first time a district is surveyed it should be done using a paper survey.
2. The IIT should have the ability to incorporate extra fields into the database and existing form interfaces. This will increase the flexibility of the tool and facilitate adoption by organisations whose primary drivers for data collection are industry based.
3. The IIT will require ongoing upgrade as the software platform it is built on continues to evolve. Management and funding of this process should be factored into any plans for roll-out of the tool.
4. The coding tables that drive the picklists behind the IIT will need periodic update as the horticultural industry evolves (eg new crop varieties, irrigation techniques come on stream). This process will need to be managed carefully to ensure consistency in data collection is maintained. Coordination and ownership of this process by an appropriate industry body may be beneficial.

5. The ability to print Crop Plans (see Attachments 2 and 4) using the IIT needs to be enhanced.
6. Uptake of the IIT within the Sunraysia region will be limited unless it has the flexibility to incorporate industry and region specific needs or mandatory WUE reporting is implemented as in SA.
7. Where required, permission from growers for data access and/or exchange be carefully written into and signed on survey forms is to comply with Privacy Act.

Where to From Here?

As momentum behind the project builds and use of the IIT becomes more widespread there are broader issues than just the technical structure of the tool that need to be considered. These relate to coordination of data collection and distribution and maintenance of the standards sitting behind the tool. These issues will need to be tackled in an environment where users of the IIT may be as diverse as community groups, irrigation authorities and industry bodies, each with their own requirements. Some of the questions that may be asked are listed below.

- **How should IIT use be coordinated?**

Crop surveys to be conducted using the IIT should be approached in a coordinated fashion so as to minimise the impact of the survey process on the community and maximise the integrity and value of the data produced. A licence agreement for use of the tool would tackle these issues in a way that would facilitate achievement of these goals. While an agreement may prove an adequate mechanism for achieving the goals, it would be advantageous if additional guidance in setting up partnerships for coordination of surveys is provided by the Murray-Darling Basin Commission (MDBC) or an appointed delegate.

- **How should information flow from crop and irrigation surveys conducted using the IIT and who should it flow to?**

A Licence Agreement would specify a minimum set of data that should be supplied to the MDBC or its partners for use in natural resource management. This information should be collected regardless of the purpose of survey conducted by the IIT adoptee. In addition to supplying the minimum data set to the MDBC or its

- partners, the IIT adopter should seek agreement from all survey participants to allow making a subset of this data publicly available for natural resource management purposes.
- **Who should be responsible for update and upkeep of the IIT as the software platform it operates on evolves?**

Due to the fact that the project is still in the trial phase, further adjustments to the operation of the IIT are likely once feedback from all trial participants has been considered. Prior to its widespread release (post 2003), any organisation adopting the tool should be made aware of this fact and should be encouraged to consider themselves part of the trial.

Subsequent updates of the software will provide users with security in their investment in data collection as the software platform it operates on (ESRI's ArcGIS 8.x) continues to evolve. As owners of the IIT Intellectual Property, it is the domain of the MDBC or an appointed delegate to undertake updates or modifications to the IIT as required.

It is therefore imperative that:

- Some forward planning is entered into which protects the MDBC's investment in the Irrigation Inventory Tool by ensuring that the right processes are in place for its continued use over many years. This means assigning responsibility for and funding upgrade and upkeep of the tool.
- Should users wish to conduct crop surveys using the IIT into the foreseeable future, they should be signatories to a licence agreement which:
 - not only protects the integrity of the software but provides a mechanism for facilitating update;
 - provides pathways for data flow back to the MDBC and its partners in the NRM arena.

REFERENCES

Kirk, J and Meldrum, D. (2001) *I2003 Milestone Report: Developing a Framework for the Irrigation Inventory Module*, Planning SA, Adelaide.

Kirk, J, Miles M and Ralph R. (1999) *Monitoring and Assessment of Change in Irrigation Districts*, Planning SA, Adelaide.

Morton Blacketer. (2002) *Irrigation Inventory Tool - Functional Specification*, Parkside, SA.

Morton Blacketer. (2002) *Irrigation Inventory Tool - Technical Specification*, Parkside, SA.

Morton Blacketer. (2002) *Irrigation Inventory Tool - Test Plan*, Parkside, SA.

ATTACHMENT 1 - MERBEIN SURVEY FORM**SURVEY Form – Property Details**

Collection Date: / / Surveyor:

Property ID:

Block ID:

Company Name:

Trading Name:

Voting Name:

Contact Name:

Contact Numbers: Phone.....Fax.....
Mobile.....
E-Mail

Mailing Address:

Do you record meter readings at the start & finish of an irrigation? Yes / No

Do you use a pump to irrigate? Yes – All or part of the property

No

Have you participated in any of the irrigation management training programs? Yes / No

Are you interested in participating in further irrigation management courses? Yes / No

I understand that the survey being conducted by SunRISE 21 Inc and the Sunraysia Rural Water Authority is to provide them with data to assist in the calculation of statistics related to Land and Water management. I understand that the individual information obtained in this survey will be used in an aggregated form and my individual information will not be released unless directed by myself in writing.

Name:Date:

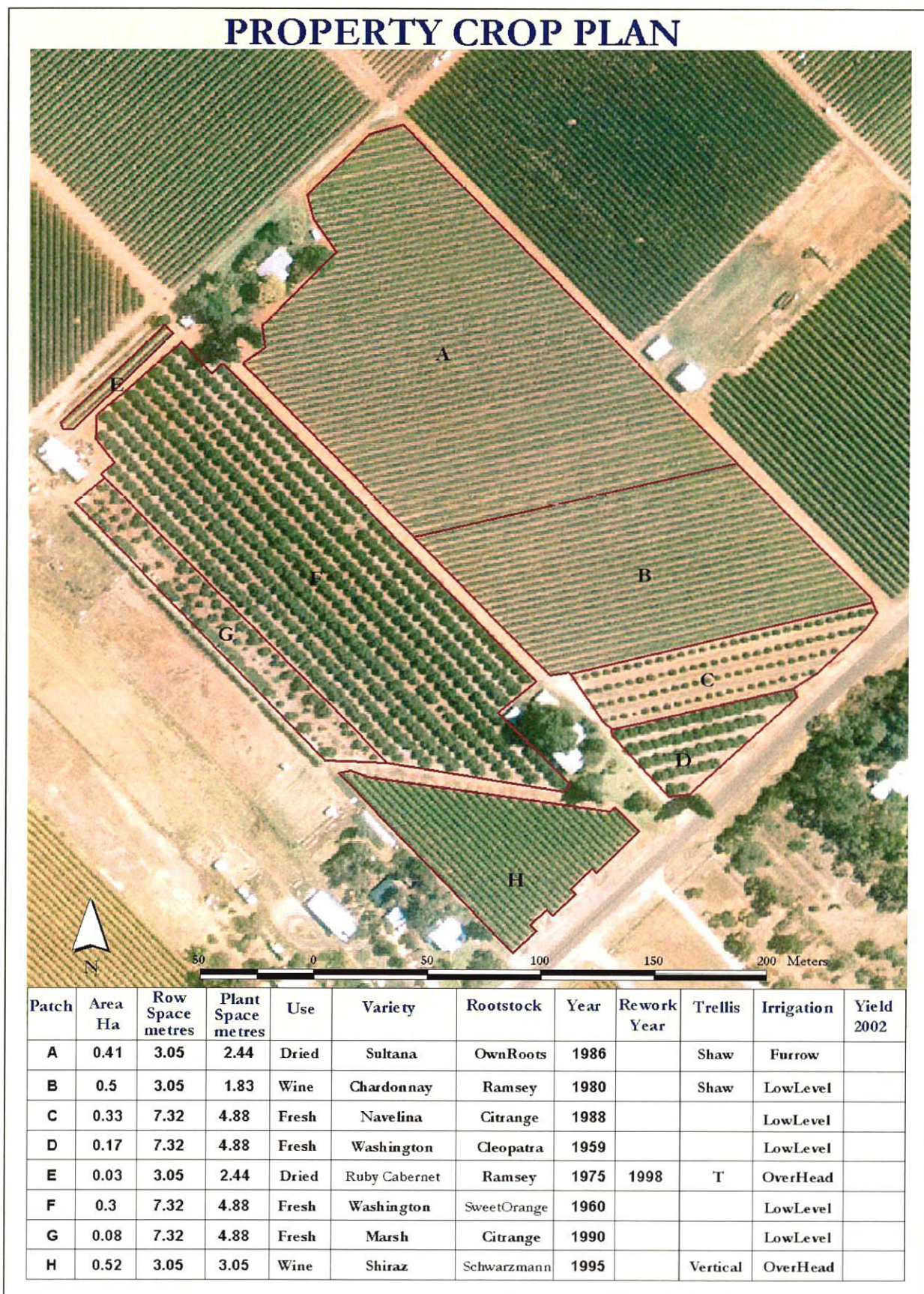
Signature:

ATTACHMENT 1 - continued


Water Details

2001-02			Details / Patches
Ground Cover During Irrigation Season	Bare Cover Crop Mulching		
Irrigation System Installed	Year		
Pumped	Yes / No		
Scheduling Method	Own Experience Shovel/Auger Forecast Use evap. Data RART Set period Soil W Monitoring Other - Specify		
Soil Moisture Monitoring Equipment	Gypsum blocks Aquaflex Enviroscn/Diviner Neutron Probe Gopher Tensiometer Addit C-Probe GB Lite Other - Specify		
Drainage Disposal	Comprehensive Reuse Bore Other - Specify		
Drainage Hazard Type	Waterlogging Salinisation Other - Specify		
Notes:			

ATTACHMENT 2 - SAMPLE CROP PLAN



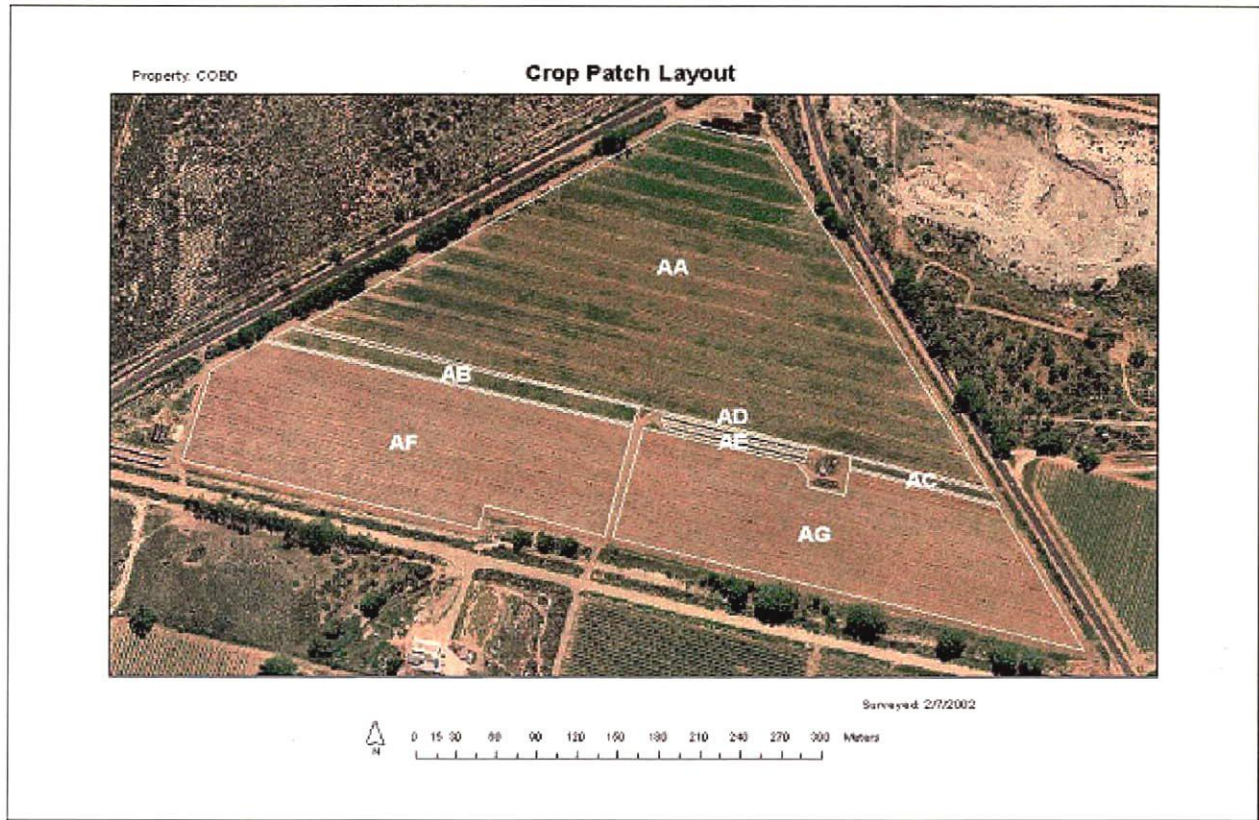
ATTACHMENT 3 - IIT PAPER SURVEY FORM USED IN COBDOGLA

 <p style="font-size: 1.2em; margin: 10px 0;">Irrigation Inventory 2001</p> <p style="font-size: 1.2em; margin: 0 0 10px 0;">Crop Surveys</p>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 2px;">Region Code</td><td style="width: 80%;"></td></tr> <tr><td style="padding: 2px;">Property ID</td><td></td></tr> <tr><td style="padding: 2px;">Outlet Numbers</td><td></td></tr> <tr><td style="padding: 2px;"> </td><td></td></tr> <tr><td style="padding: 2px;">Section Numbers</td><td></td></tr> <tr><td style="padding: 2px;"> </td><td></td></tr> <tr><td style="padding: 2px;">Surveyed by</td><td></td></tr> </table>	Region Code		Property ID		Outlet Numbers				Section Numbers				Surveyed by	
Region Code																
Property ID																
Outlet Numbers																
Section Numbers																
Surveyed by																
Contact Person:																
Telephone No:																
Mobile Phone No:																
Email Address:																
Meter Reading Frequency <div style="display: flex; justify-content: space-between; margin-top: 5px;"> Each Irrigation <input type="checkbox"/> Monthly <input type="checkbox"/> Weekly <input type="checkbox"/> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> Never <input type="checkbox"/> Fortnightly <input type="checkbox"/> Random <input type="checkbox"/> </div> <div style="margin-top: 5px;"> Other </div>																
What area of the property is pumped? <div style="display: flex; justify-content: space-around; margin-top: 5px;"> All <input type="checkbox"/> None <input type="checkbox"/> </div> <div style="margin-top: 5px;"> Part <input type="checkbox"/> </div>																
Have you participated in any of the irrigation management training programs? e.g. RiverCare <div style="margin-top: 5px;"> No <input type="checkbox"/> </div> <div style="margin-top: 5px;"> Yes <input type="checkbox"/> </div>																
Are you interested in participating in further irrigation management courses? <div style="margin-top: 5px;"> No <input type="checkbox"/> </div> <div style="margin-top: 5px;"> Yes <input type="checkbox"/> </div>																
<p>I understand that the survey conducted by Central Irrigation Trust is to provide data to assist in the calculation of statistics related to Land and Water Management.</p> <p>I understand the individual information obtained in this survey will be used in an aggregated form and my individual information will not be released unless directed by myself in writing.</p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> Name Signed Date </div>																

Irrigation Inventory - 2001		Region Code		Property ID		CROPS		CROP PATCHES AA to AG	
	Patch AA	Patch AB	Patch AC	Patch AD	Patch AE	Patch AF	Patch AG		
Year Planted									
Crop Type	Vines <input type="checkbox"/>	Vines <input type="checkbox"/>	Vines <input type="checkbox"/>	Vines <input type="checkbox"/>	Vines <input type="checkbox"/>	Vines <input type="checkbox"/>	Vines <input type="checkbox"/>	Vines <input type="checkbox"/>	Vines <input type="checkbox"/>
	Citrus <input type="checkbox"/>	Citrus <input type="checkbox"/>	Citrus <input type="checkbox"/>	Citrus <input type="checkbox"/>	Citrus <input type="checkbox"/>	Citrus <input type="checkbox"/>	Citrus <input type="checkbox"/>	Citrus <input type="checkbox"/>	Citrus <input type="checkbox"/>
	Stonefruit <input type="checkbox"/>	Stonefruit <input type="checkbox"/>	Stonefruit <input type="checkbox"/>	Stonefruit <input type="checkbox"/>	Stonefruit <input type="checkbox"/>	Stonefruit <input type="checkbox"/>	Stonefruit <input type="checkbox"/>	Stonefruit <input type="checkbox"/>	Stonefruit <input type="checkbox"/>
	Pomefruit <input type="checkbox"/>	Pomefruit <input type="checkbox"/>	Pomefruit <input type="checkbox"/>	Pomefruit <input type="checkbox"/>	Pomefruit <input type="checkbox"/>	Pomefruit <input type="checkbox"/>	Pomefruit <input type="checkbox"/>	Pomefruit <input type="checkbox"/>	Pomefruit <input type="checkbox"/>
	Vegetables <input type="checkbox"/>	Vegetables <input type="checkbox"/>	Vegetables <input type="checkbox"/>	Vegetables <input type="checkbox"/>	Vegetables <input type="checkbox"/>	Vegetables <input type="checkbox"/>	Vegetables <input type="checkbox"/>	Vegetables <input type="checkbox"/>	Vegetables <input type="checkbox"/>
	Pasture <input type="checkbox"/>	Pasture <input type="checkbox"/>	Pasture <input type="checkbox"/>	Pasture <input type="checkbox"/>	Pasture <input type="checkbox"/>	Pasture <input type="checkbox"/>	Pasture <input type="checkbox"/>	Pasture <input type="checkbox"/>	Pasture <input type="checkbox"/>
	Nut Tree <input type="checkbox"/>	Nut Tree <input type="checkbox"/>	Nut Tree <input type="checkbox"/>	Nut Tree <input type="checkbox"/>	Nut Tree <input type="checkbox"/>	Nut Tree <input type="checkbox"/>	Nut Tree <input type="checkbox"/>	Nut Tree <input type="checkbox"/>	Nut Tree <input type="checkbox"/>
	Berries <input type="checkbox"/>	Berries <input type="checkbox"/>	Berries <input type="checkbox"/>	Berries <input type="checkbox"/>	Berries <input type="checkbox"/>	Berries <input type="checkbox"/>	Berries <input type="checkbox"/>	Berries <input type="checkbox"/>	Berries <input type="checkbox"/>
	Tropical Fruit <input type="checkbox"/>	Tropical Fruit <input type="checkbox"/>	Tropical Fruit <input type="checkbox"/>	Tropical Fruit <input type="checkbox"/>	Tropical Fruit <input type="checkbox"/>	Tropical Fruit <input type="checkbox"/>	Tropical Fruit <input type="checkbox"/>	Tropical Fruit <input type="checkbox"/>	Tropical Fruit <input type="checkbox"/>
	Woodlot <input type="checkbox"/>	Woodlot <input type="checkbox"/>	Woodlot <input type="checkbox"/>	Woodlot <input type="checkbox"/>	Woodlot <input type="checkbox"/>	Woodlot <input type="checkbox"/>	Woodlot <input type="checkbox"/>	Woodlot <input type="checkbox"/>	Woodlot <input type="checkbox"/>
	Misc. Horticulture <input type="checkbox"/>	Misc. Horticulture <input type="checkbox"/>	Misc. Horticulture <input type="checkbox"/>	Misc. Horticulture <input type="checkbox"/>	Misc. Horticulture <input type="checkbox"/>	Misc. Horticulture <input type="checkbox"/>	Misc. Horticulture <input type="checkbox"/>	Misc. Horticulture <input type="checkbox"/>	Misc. Horticulture <input type="checkbox"/>
	Misc. Agriculture <input type="checkbox"/>	Misc. Agriculture <input type="checkbox"/>	Misc. Agriculture <input type="checkbox"/>	Misc. Agriculture <input type="checkbox"/>	Misc. Agriculture <input type="checkbox"/>	Misc. Agriculture <input type="checkbox"/>	Misc. Agriculture <input type="checkbox"/>	Misc. Agriculture <input type="checkbox"/>	Misc. Agriculture <input type="checkbox"/>
	Vacant Non-Prod. <input type="checkbox"/>	Vacant Non-Prod. <input type="checkbox"/>	Vacant Non-Prod. <input type="checkbox"/>	Vacant Non-Prod. <input type="checkbox"/>	Vacant Non-Prod. <input type="checkbox"/>	Vacant Non-Prod. <input type="checkbox"/>	Vacant Non-Prod. <input type="checkbox"/>	Vacant Non-Prod. <input type="checkbox"/>	Vacant Non-Prod. <input type="checkbox"/>
	Vacant Horticulture <input type="checkbox"/>	Vacant Horticulture <input type="checkbox"/>	Vacant Horticulture <input type="checkbox"/>	Vacant Horticulture <input type="checkbox"/>	Vacant Horticulture <input type="checkbox"/>	Vacant Horticulture <input type="checkbox"/>	Vacant Horticulture <input type="checkbox"/>	Vacant Horticulture <input type="checkbox"/>	Vacant Horticulture <input type="checkbox"/>
Category									
Variety									
Rootstock	Own Rooted <input type="checkbox"/>	Own Rooted <input type="checkbox"/>	Own Rooted <input type="checkbox"/>	Own Rooted <input type="checkbox"/>	Own Rooted <input type="checkbox"/>	Own Rooted <input type="checkbox"/>	Own Rooted <input type="checkbox"/>	Own Rooted <input type="checkbox"/>	Own Rooted <input type="checkbox"/>
Variety									
Interplantings	Interplanted <input type="checkbox"/>	Interplanted <input type="checkbox"/>	Interplanted <input type="checkbox"/>	Interplanted <input type="checkbox"/>	Interplanted <input type="checkbox"/>	Interplanted <input type="checkbox"/>	Interplanted <input type="checkbox"/>	Interplanted <input type="checkbox"/>	Interplanted <input type="checkbox"/>
Crop Use	Cannery <input type="checkbox"/>	Cannery <input type="checkbox"/>	Cannery <input type="checkbox"/>	Cannery <input type="checkbox"/>	Cannery <input type="checkbox"/>	Cannery <input type="checkbox"/>	Cannery <input type="checkbox"/>	Cannery <input type="checkbox"/>	Cannery <input type="checkbox"/>
	Dried Fruit <input type="checkbox"/>	Dried Fruit <input type="checkbox"/>	Dried Fruit <input type="checkbox"/>	Dried Fruit <input type="checkbox"/>	Dried Fruit <input type="checkbox"/>	Dried Fruit <input type="checkbox"/>	Dried Fruit <input type="checkbox"/>	Dried Fruit <input type="checkbox"/>	Dried Fruit <input type="checkbox"/>
	Fresh Fruit <input type="checkbox"/>	Fresh Fruit <input type="checkbox"/>	Fresh Fruit <input type="checkbox"/>	Fresh Fruit <input type="checkbox"/>	Fresh Fruit <input type="checkbox"/>	Fresh Fruit <input type="checkbox"/>	Fresh Fruit <input type="checkbox"/>	Fresh Fruit <input type="checkbox"/>	Fresh Fruit <input type="checkbox"/>
	Juicing <input type="checkbox"/>	Juicing <input type="checkbox"/>	Juicing <input type="checkbox"/>	Juicing <input type="checkbox"/>	Juicing <input type="checkbox"/>	Juicing <input type="checkbox"/>	Juicing <input type="checkbox"/>	Juicing <input type="checkbox"/>	Juicing <input type="checkbox"/>
	Winery Bulk <input type="checkbox"/>	Winery Bulk <input type="checkbox"/>	Winery Bulk <input type="checkbox"/>	Winery Bulk <input type="checkbox"/>	Winery Bulk <input type="checkbox"/>	Winery Bulk <input type="checkbox"/>	Winery Bulk <input type="checkbox"/>	Winery Bulk <input type="checkbox"/>	Winery Bulk <input type="checkbox"/>
	Winery Prem <input type="checkbox"/>	Winery Premium <input type="checkbox"/>	Winery Premium <input type="checkbox"/>	Winery Premium <input type="checkbox"/>	Winery Premium <input type="checkbox"/>	Winery Premium <input type="checkbox"/>	Winery Premium <input type="checkbox"/>	Winery Premium <input type="checkbox"/>	Winery Premium <input type="checkbox"/>
	Own Use <input type="checkbox"/>	Own Use <input type="checkbox"/>	Own Use <input type="checkbox"/>	Own Use <input type="checkbox"/>	Own Use <input type="checkbox"/>	Own Use <input type="checkbox"/>	Own Use <input type="checkbox"/>	Own Use <input type="checkbox"/>	Own Use <input type="checkbox"/>
Other - Specify									
Ground Cover	Bare <input type="checkbox"/>	Bare <input type="checkbox"/>	Bare <input type="checkbox"/>	Bare <input type="checkbox"/>	Bare <input type="checkbox"/>	Bare <input type="checkbox"/>	Bare <input type="checkbox"/>	Bare <input type="checkbox"/>	Bare <input type="checkbox"/>
During	Cover Crop <input type="checkbox"/>	Cover Crop <input type="checkbox"/>	Cover Crop <input type="checkbox"/>	Cover Crop <input type="checkbox"/>	Cover Crop <input type="checkbox"/>	Cover Crop <input type="checkbox"/>	Cover Crop <input type="checkbox"/>	Cover Crop <input type="checkbox"/>	Cover Crop <input type="checkbox"/>
Irrig Season	Cover Crop - perm <input type="checkbox"/>	Cover Crop - perm <input type="checkbox"/>	Cover Crop - perm <input type="checkbox"/>	Cover Crop - perm <input type="checkbox"/>	Cover Crop - perm <input type="checkbox"/>	Cover Crop - perm <input type="checkbox"/>	Cover Crop - perm <input type="checkbox"/>	Cover Crop - perm <input type="checkbox"/>	Cover Crop - perm <input type="checkbox"/>
	Cover Crop - seas <input type="checkbox"/>	Cover Crop - seas <input type="checkbox"/>	Cover Crop - seas <input type="checkbox"/>	Cover Crop - seas <input type="checkbox"/>	Cover Crop - seas <input type="checkbox"/>	Cover Crop - seas <input type="checkbox"/>	Cover Crop - seas <input type="checkbox"/>	Cover Crop - seas <input type="checkbox"/>	Cover Crop - seas <input type="checkbox"/>
Tree Count (Citrus only)									
Reworked (yr)									

Irrigation Inventory - 2001		Region Code		Property ID		WATER		CROP PATCHES AA to AG	
	Patch	AA	AB	AC	AD	AE	AF	AG	
Drained (Y/N)									
Irrigation System	Overhead <input type="checkbox"/>	Overhead <input type="checkbox"/>	Overhead <input type="checkbox"/>	Overhead <input type="checkbox"/>	Overhead <input type="checkbox"/>	Overhead <input type="checkbox"/>	Overhead <input type="checkbox"/>	Overhead <input type="checkbox"/>	Overhead <input type="checkbox"/>
	Under Canopy <input type="checkbox"/>	Under Canopy <input type="checkbox"/>	Under Canopy <input type="checkbox"/>	Under Canopy <input type="checkbox"/>	Under Canopy <input type="checkbox"/>	Under Canopy <input type="checkbox"/>	Under Canopy <input type="checkbox"/>	Under Canopy <input type="checkbox"/>	Under Canopy <input type="checkbox"/>
	Microsprinkler <input type="checkbox"/>	Microsprinkler <input type="checkbox"/>	Microsprinkler <input type="checkbox"/>	Microsprinkler <input type="checkbox"/>	Microsprinkler <input type="checkbox"/>	Microsprinkler <input type="checkbox"/>	Microsprinkler <input type="checkbox"/>	Microsprinkler <input type="checkbox"/>	Microsprinkler <input type="checkbox"/>
	Drip <input type="checkbox"/>	Drip <input type="checkbox"/>	Drip <input type="checkbox"/>	Drip <input type="checkbox"/>	Drip <input type="checkbox"/>	Drip <input type="checkbox"/>	Drip <input type="checkbox"/>	Drip <input type="checkbox"/>	Drip <input type="checkbox"/>
	Furrow <input type="checkbox"/>	Furrow <input type="checkbox"/>	Furrow <input type="checkbox"/>	Furrow <input type="checkbox"/>	Furrow <input type="checkbox"/>	Furrow <input type="checkbox"/>	Furrow <input type="checkbox"/>	Furrow <input type="checkbox"/>	Furrow <input type="checkbox"/>
	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>
	Flood <input type="checkbox"/>	Flood <input type="checkbox"/>	Flood <input type="checkbox"/>	Flood <input type="checkbox"/>	Flood <input type="checkbox"/>	Flood <input type="checkbox"/>	Flood <input type="checkbox"/>	Flood <input type="checkbox"/>	Flood <input type="checkbox"/>
Other - Specify									
Drainage System	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>	Sub-surface <input type="checkbox"/>
	Surface (Trench) <input type="checkbox"/>	Surface (Trench) <input type="checkbox"/>	Surface (Trench) <input type="checkbox"/>	Surface (Trench) <input type="checkbox"/>	Surface (Trench) <input type="checkbox"/>	Surface (Trench) <input type="checkbox"/>	Surface (Trench) <input type="checkbox"/>	Surface (Trench) <input type="checkbox"/>	Surface (Trench) <input type="checkbox"/>
Drainage Disposal	Comprehensive <input type="checkbox"/>	Comprehensive <input type="checkbox"/>	Comprehensive <input type="checkbox"/>	Comprehensive <input type="checkbox"/>	Comprehensive <input type="checkbox"/>	Comprehensive <input type="checkbox"/>	Comprehensive <input type="checkbox"/>	Comprehensive <input type="checkbox"/>	Comprehensive <input type="checkbox"/>
	Reuse <input type="checkbox"/>	Reuse <input type="checkbox"/>	Reuse <input type="checkbox"/>	Reuse <input type="checkbox"/>	Reuse <input type="checkbox"/>	Reuse <input type="checkbox"/>	Reuse <input type="checkbox"/>	Reuse <input type="checkbox"/>	Reuse <input type="checkbox"/>
	Bore <input type="checkbox"/>	Bore <input type="checkbox"/>	Bore <input type="checkbox"/>	Bore <input type="checkbox"/>	Bore <input type="checkbox"/>	Bore <input type="checkbox"/>	Bore <input type="checkbox"/>	Bore <input type="checkbox"/>	Bore <input type="checkbox"/>
Other - Specify									
IDMP copy available	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>	Yes <input type="checkbox"/>
	No <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>	No <input type="checkbox"/>
Drainage Hazard	Waterlogging <input type="checkbox"/>	Waterlogging <input type="checkbox"/>	Waterlogging <input type="checkbox"/>	Waterlogging <input type="checkbox"/>	Waterlogging <input type="checkbox"/>	Waterlogging <input type="checkbox"/>	Waterlogging <input type="checkbox"/>	Waterlogging <input type="checkbox"/>	Waterlogging <input type="checkbox"/>
Type	Salinisation <input type="checkbox"/>	Salinisation <input type="checkbox"/>	Salinisation <input type="checkbox"/>	Salinisation <input type="checkbox"/>	Salinisation <input type="checkbox"/>	Salinisation <input type="checkbox"/>	Salinisation <input type="checkbox"/>	Salinisation <input type="checkbox"/>	Salinisation <input type="checkbox"/>
Year Installed									
Scheduling Method (tick one)	Own experience <input type="checkbox"/>	Own experience <input type="checkbox"/>	Own experience <input type="checkbox"/>	Own experience <input type="checkbox"/>	Own experience <input type="checkbox"/>	Own experience <input type="checkbox"/>	Own experience <input type="checkbox"/>	Own experience <input type="checkbox"/>	Own experience <input type="checkbox"/>
	Shovel/Auger <input type="checkbox"/>	Shovel/Auger <input type="checkbox"/>	Shovel/Auger <input type="checkbox"/>	Shovel/Auger <input type="checkbox"/>	Shovel/Auger <input type="checkbox"/>	Shovel/Auger <input type="checkbox"/>	Shovel/Auger <input type="checkbox"/>	Shovel/Auger <input type="checkbox"/>	Shovel/Auger <input type="checkbox"/>
	Forecast <input type="checkbox"/>	Forecast <input type="checkbox"/>	Forecast <input type="checkbox"/>	Forecast <input type="checkbox"/>	Forecast <input type="checkbox"/>	Forecast <input type="checkbox"/>	Forecast <input type="checkbox"/>	Forecast <input type="checkbox"/>	Forecast <input type="checkbox"/>
	Use evap. data <input type="checkbox"/>	Use evap. data <input type="checkbox"/>	Use evap. data <input type="checkbox"/>	Use evap. data <input type="checkbox"/>	Use evap. data <input type="checkbox"/>	Use evap. data <input type="checkbox"/>	Use evap. data <input type="checkbox"/>	Use evap. data <input type="checkbox"/>	Use evap. data <input type="checkbox"/>
	RART <input type="checkbox"/>	RART <input type="checkbox"/>	RART <input type="checkbox"/>	RART <input type="checkbox"/>	RART <input type="checkbox"/>	RART <input type="checkbox"/>	RART <input type="checkbox"/>	RART <input type="checkbox"/>	RART <input type="checkbox"/>
	Set period <input type="checkbox"/>	Set period <input type="checkbox"/>	Set period <input type="checkbox"/>	Set period <input type="checkbox"/>	Set period <input type="checkbox"/>	Set period <input type="checkbox"/>	Set period <input type="checkbox"/>	Set period <input type="checkbox"/>	Set period <input type="checkbox"/>
	Soil W Monitoring <input type="checkbox"/>	Soil W Monitoring <input type="checkbox"/>	Soil W Monitoring <input type="checkbox"/>	Soil W Monitoring <input type="checkbox"/>	Soil W Monitoring <input type="checkbox"/>	Soil W Monitoring <input type="checkbox"/>	Soil W Monitoring <input type="checkbox"/>	Soil W Monitoring <input type="checkbox"/>	Soil W Monitoring <input type="checkbox"/>
Other - Specify									
Soil Water Monitoring Equipment	Gypsum blocks <input type="checkbox"/>	Gypsum blocks <input type="checkbox"/>	Gypsum blocks <input type="checkbox"/>	Gypsum blocks <input type="checkbox"/>	Gypsum blocks <input type="checkbox"/>	Gypsum blocks <input type="checkbox"/>	Gypsum blocks <input type="checkbox"/>	Gypsum blocks <input type="checkbox"/>	Gypsum blocks <input type="checkbox"/>
	Aquaflux <input type="checkbox"/>	Aquaflux <input type="checkbox"/>	Aquaflux <input type="checkbox"/>	Aquaflux <input type="checkbox"/>	Aquaflux <input type="checkbox"/>	Aquaflux <input type="checkbox"/>	Aquaflux <input type="checkbox"/>	Aquaflux <input type="checkbox"/>	Aquaflux <input type="checkbox"/>
	Enviroson/Diviner <input type="checkbox"/>	Enviroson/Diviner <input type="checkbox"/>	Enviroson/Diviner <input type="checkbox"/>	Enviroson/Diviner <input type="checkbox"/>	Enviroson/Diviner <input type="checkbox"/>	Enviroson/Diviner <input type="checkbox"/>	Enviroson/Diviner <input type="checkbox"/>	Enviroson/Diviner <input type="checkbox"/>	Enviroson/Diviner <input type="checkbox"/>
	Neutron Probe <input type="checkbox"/>	Neutron Probe <input type="checkbox"/>	Neutron Probe <input type="checkbox"/>	Neutron Probe <input type="checkbox"/>	Neutron Probe <input type="checkbox"/>	Neutron Probe <input type="checkbox"/>	Neutron Probe <input type="checkbox"/>	Neutron Probe <input type="checkbox"/>	Neutron Probe <input type="checkbox"/>
	Gopher <input type="checkbox"/>	Gopher <input type="checkbox"/>	Gopher <input type="checkbox"/>	Gopher <input type="checkbox"/>	Gopher <input type="checkbox"/>	Gopher <input type="checkbox"/>	Gopher <input type="checkbox"/>	Gopher <input type="checkbox"/>	Gopher <input type="checkbox"/>
	Tensiometer <input type="checkbox"/>	Tensiometer <input type="checkbox"/>	Tensiometer <input type="checkbox"/>	Tensiometer <input type="checkbox"/>	Tensiometer <input type="checkbox"/>	Tensiometer <input type="checkbox"/>	Tensiometer <input type="checkbox"/>	Tensiometer <input type="checkbox"/>	Tensiometer <input type="checkbox"/>
	Add C-Probe <input type="checkbox"/>	Add C-Probe <input type="checkbox"/>	Add C-Probe <input type="checkbox"/>	Add C-Probe <input type="checkbox"/>	Add C-Probe <input type="checkbox"/>	Add C-Probe <input type="checkbox"/>	Add C-Probe <input type="checkbox"/>	Add C-Probe <input type="checkbox"/>	Add C-Probe <input type="checkbox"/>
	GB Lite <input type="checkbox"/>	GB Lite <input type="checkbox"/>	GB Lite <input type="checkbox"/>	GB Lite <input type="checkbox"/>	GB Lite <input type="checkbox"/>	GB Lite <input type="checkbox"/>	GB Lite <input type="checkbox"/>	GB Lite <input type="checkbox"/>	GB Lite <input type="checkbox"/>
Other - Specify									
Number of Testwells									
Pumped (Y/N)									

ATTACHMENT 4 - IIT OUTPUTS



Property ID COBD0000

Grower's Crop Information

Patch ID	Area (ha)	Area (acres)	Outlet No	Crop Variety	Year Planted
AA	0.85	2.09	2633	Gordo	2001
AB	0.39	0.96	2633	Gordo	1984
AC	0.37	0.91	2633	Valencia	1990
AD	0.06	0.16	2633	Navel - Barnfield	1997
AE	0.30	0.74	2633	Navel - Wilson	1990
AF	0.24	0.59	2633	Chardonnay	1998
AG	0.26	0.65	2633	Chardonnay	1997
AH	0.29	0.72	2633	Chardonnay	1996
AI	0.98	2.43	2633	Cabernet Sauvignon	1996
AJ	0.78	1.93	2633	Cabernet Sauvignon	2000
AK	0.18	0.45	2633	Chardonnay	2001
AL	0.36	0.90	2633	Cabernet Sauvignon	1999
AM	0.19	0.47	2633	Cabernet Sauvignon	1999
AN	0.20	0.50	2633	Cabernet Sauvignon	1998
AO	0.16	0.39	2633	Cabernet Sauvignon	1997
AP	0.71	1.76	2633	Chardonnay	1992

ATTACHMENT 5 - FUNCTIONAL SPECIFICATION FOR THE IIT



Dept for Environment and Heritage

Irrigation Inventory Tool

Functional Specification

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CLIENT ACCEPTANCE & SIGN-OFF

I have read this document and agree that it describes the scope of the project.

Signature

Date/...../.....

Name

Position

1. INTRODUCTION

The Inventory Irrigation Tool (IIT) will be used to collect base information on crops and irrigation systems at the property and patch levels. The IIT will be a GIS based tool utilising ESRI's ArcGIS Software to allow the capture of accurate spatially based information on crop types and irrigation. An application will be developed to load a customised version of ESRI's ArcView software that will provide the functionality required by the Department for Environment And Heritage.

LOGON

When opening the IIT, the user will be asked to enter a username and password to establish permissions and access rights.

If a user logs on as an administrator, they will have the ability to set up a survey. They can therefore select how detailed the survey will be, select the editable fields of a patch feature class and create a template geo-database for use in a survey. An administrator will have the ability to restore a survey database and to modify the user names and passwords within the template database.

If a user does not logon as an administrator, they will not have the ability to set up a survey, restore a database or modify user names and passwords. However, they will be able to perform a survey and print out property plans.

DATABASE SECURITY

ArcView does not function with a secure personal geo-database, ie geo-databases with a set user name and password. Alternative means will be employed to prevent data corruption. These include:

- Backing up the survey database each time the IIT is started.
- Copying of the live database to the C:\IIMSsurveys\Current standard survey folder each time the IIT is closed down.
- Maintaining two database backups. The live database will be copied and located in the C:\IIMSsurveys\Current\databasebackup standard survey subfolder.
- Hiding the live database in a folder called "wue" within the System32 directory
- Changing the live database extension from .mdb to .srg when the user exits IIT. The extension will be renamed to .mdb on start up.

SURVEY SETUP

If a user logs on as an administrator they will have the ability via a menu option to set up a survey.

General Information

If the administrator selects "Survey Setup" from the "Administrative" menu, they will have the ability to open a General Information form from a sub menu. This form will allow the following information to be viewed, entered or edited:

- Region name, Region Abbreviation
- Organisation Name, Organisation Acronym, Client Name, Client Acronym
- Survey Year, Whether or not to map Water as well as Crop, Location of Water to Ground
- Surveyor Names and Passwords
- Administrator Name, Land Cover

Depending on the information entered in the General Information form, two surveys may be available for selection; these include the Crop survey and the Irrigation Survey.

Setting the Data Source

Once the General Information form has been completed and saved, an additional menu item "Set Data Source" will become available for use. This item will allow the setting of the data source for use in creating the new survey database. If this item is selected, a dialog box will be displayed allowing the user to browse to an ortho photograph (.ecw file) or an Access Database. If the user browses to an Access Database, the dialog box will allow feature classes from the database to be selected. If the database contains only "Property" spatial information ie properties which do not have PatchIDs yet assigned, the feature class name will be "fcBasePatch". If the database contains information from a previous survey then the name of the feature class will depend on the detail level of the survey at survey set up. One feature class will be used to hold both Crop and Irrigation Data. The name will be a combination of both crop and water detail levels and these are displayed in the table below:

Survey Detail Level	Feature Class Name
Crop Type	fcCropType
Crop Variety	fcCropVariety
Crop Rootstock	fcCropRootstock
Crop Type And Water WTG	fcCropTypeWaterWTG
Crop Type And Water Irrigation Systems	fcCropTypeWaterIrrigationSystems
Crop Type And Water Valve Unit	fcCropTypeWaterValveUnit
Crop Variety And Water WTG	fcCropVarietyWaterWTG
Crop Variety And Water Irrigation Systems	fcCropVarietyWaterIrrigationSystems
Crop Variety And Water Valve Unit	fcCropVarietyWaterValveUnit
Crop Rootstock And Water WTG	fcCropRootstockWaterWTG
Crop Rootstock And Water Irrigation Systems	fcCropRootstockWaterIrrigationSystems
Crop Rootstock And Water Valve Unit	fcCropRootstockWaterValveUnit

Figure 1.0

Crop Survey

Once the data source has been set, another menu item labelled "Crop" will allow the administrator to set the detail level of the Crop Survey. The options available will include:

- Same as Data Source
- Crop Type
- Crop Variety
- Crop Rootstock

The last three of the above options will display a form allowing the selection of optional fields. Default fields will also be displayed on this form but will not be available for selection. If one of the last three options is selected, then the new feature class will be modified in accordance to the optional fields selected.

For default and optional fields for all levels please refer to Appendix 1

Water Survey

Once the "Crop" detail level and optional fields have been set, the "Water" menu item will become enabled assuming the Irrigation Survey check box on the General Information Form had been checked. This will allow the administrator to set the detail level of the Irrigation Survey. The options available will include:

- Same as Data Source
- Water WTG
- Water Irrigation Systems
- Water Valve Unit.

The last three of the above options will display a form allowing the selection of optional fields. Default fields will also be displayed on this form but will not be available for selection. If one of the last three options is selected, then the new feature class will be modified in accordance to the optional fields selected.

For default and optional fields for all levels please refer to Appendix 1

Create Survey Database

Once the "Water" detail level and optional fields have been set, an additional menu item labelled "Create Survey Database" will become enabled. When this item is selected, the survey database will be automatically created and placed in the C:\IIMSsurveys\Current standard survey folder. This folder will be created by the set up application SETUP.EXE, as described in Section 10.

As specified above, three detail levels will be available for selection and the level selected will determine the default and optional fields that may be included for editing. The default fields will be automatically included in the feature class whereas the optional fields will be available on a form for selection. Both default fields and selected optional fields will then be added to the feature class on creation of the survey geo-database. UserID and ChangeTimeStamp will also be included as fields to store data on who has modified patch data. UserID will be the foreign key to UserID in the Users Table.

Unallocated PropertyIDs

When the survey personal geo-database is created, the IIT will automatically search the feature class for PropertyIDs that do not exist in the Properties table. New records will be created in the Properties table for those IDs. The IIT will automatically create a range of propertyIDs, for use on unallocated properties, for those Surveyors that have been assigned to the District. The number range assigned will be based on the assumption that a District has no more than 1000 properties and each surveyor will have a unique number range. The numbers ranges assigned to each surveyor will be place in the Users table.

If a survey has been created from an ortho photograph, where no properties have been defined, then the number range will depend on the number of surveyors for the District. For example, if there are 4 surveyors, then surveyor "A" will have a PropertyID number range from 001 – 250 and surveyor "B" will have a number range from 251-500.

If the survey has been created from a feature class, where some properties have been defined, the IIT will first determine the current maximum PropertyID. The number range assigned to each surveyor will depend on this value to ensure each property has a unique property ID. For example, if the current maximum PropertyID is 560 and there are 4 surveyors, then surveyor "A" will have a number range from 561-670($(1000-560)/4 + 560$).

Database Formats

When a survey database is set up, the IIT will only allow a template geo-database to be selected if it is an Access Database. This means that after data from several personal geo-databases have been merged, which may occur after a crop survey for example, the resulting database will need to be personal geo-database in the .mdb format.

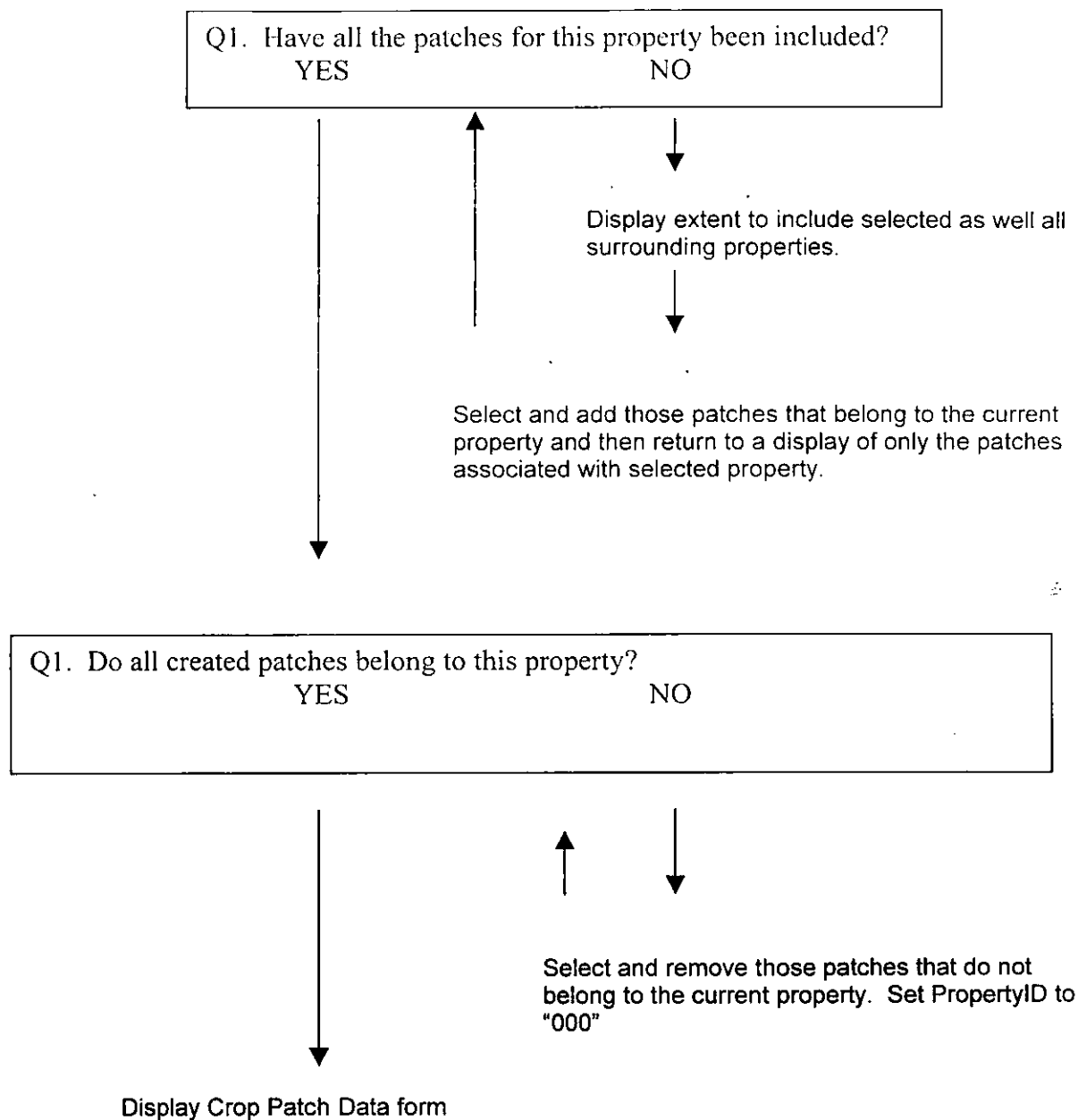
PROPERTY SELECTION AND MAINTENANCE

If a user logs on as a surveyor, or administrator they will have the ability via a "Properties Selection" form, to maintain information for that property, and also to select that property for crop and irrigation patch edits. This form will include a search capability and a grid, displaying a list of properties. It will also be available by selecting a menu item from the Main Menu. On the first occasion, the grid will contain only property IDs. However, on proceeding surveys, it will display additional property information, including Land Holder and Contact Name. If, on survey set up, unallocated PropertyIDs had been added to the Properties table, this form will only display those IDs that are available for use by the logged on user.

Once a selection is made, the IIT will zoom to the extent of the property, from a full extent, so that only patches belonging to that property are displayed. However, it will not zoom to an editing scale below or greater than that specified at survey set up.

If the user selects a property that has an unallocated PropertyID, a warning will be displayed and the map will remain at full extent. The user will then be required to use the native ArcMap tools to navigate and zoom to the extent of the property.

Before being allowed to proceed with the survey and edit the patch data, the user will be asked two questions to validate the patches that have been assigned to the property. The proceeding course of action is illustrated below and will depend on the response to the dialog boxes.



During the process of patch validation, the user will have the ability to add, split and merge patches.

Figure 1.1

CROP PATCH EDIT

When a Crop survey is carried out at the Crop Type level, the application caption will read "IIT Crop Survey – Crop Type Survey". This caption will be modified according to the level of survey undertaken.

ArcView allows new polygons to be added and current polygons to be split or merged by selecting the required menu item and performing the required mouse and line movements. Crop patches or polygons will be added, split or merged in the IIT as is currently performed in ArcView. The IIT however, will have more appropriate menu list names in accordance with the purpose of the tool.

In the IIT, surveyors will have the ability to modify data for multiple crop patches at the same time. If a user is performing a Crop survey, a menu item called "Select By Patch" will be available via the "Selection" menu. When selected, this will display a form allowing the selection of one or more Patches, even if Irrigation line work exists on the layer. Once patches have been selected, the user will have the ability to right click on the map to display a pop-up menu and then select "Crop Patch Data" from the list. This will display a form with the two tabs, "Mandatory Data" and "Optional Data" thereby allowing the edit of all data required for the Crop Survey. If the surveyor fails to fill in all mandatory data for the selected patch/s, then a warning will be displayed but they will still have the ability to proceed and apply the added or modified data.

All patches that have mandatory data filled in will be coloured light green and all patches that do not have all mandatory data filled will be coloured light red. This will provide a visual representation of the patches that have been analysed by the surveyor.

The Table of Contents or Layers window, which is displayed by default when ArcView is opened, as shown in Figure 1.1 below, will not be displayed in IIT. However, user will have the ability to turn on and off layers via a menu item.

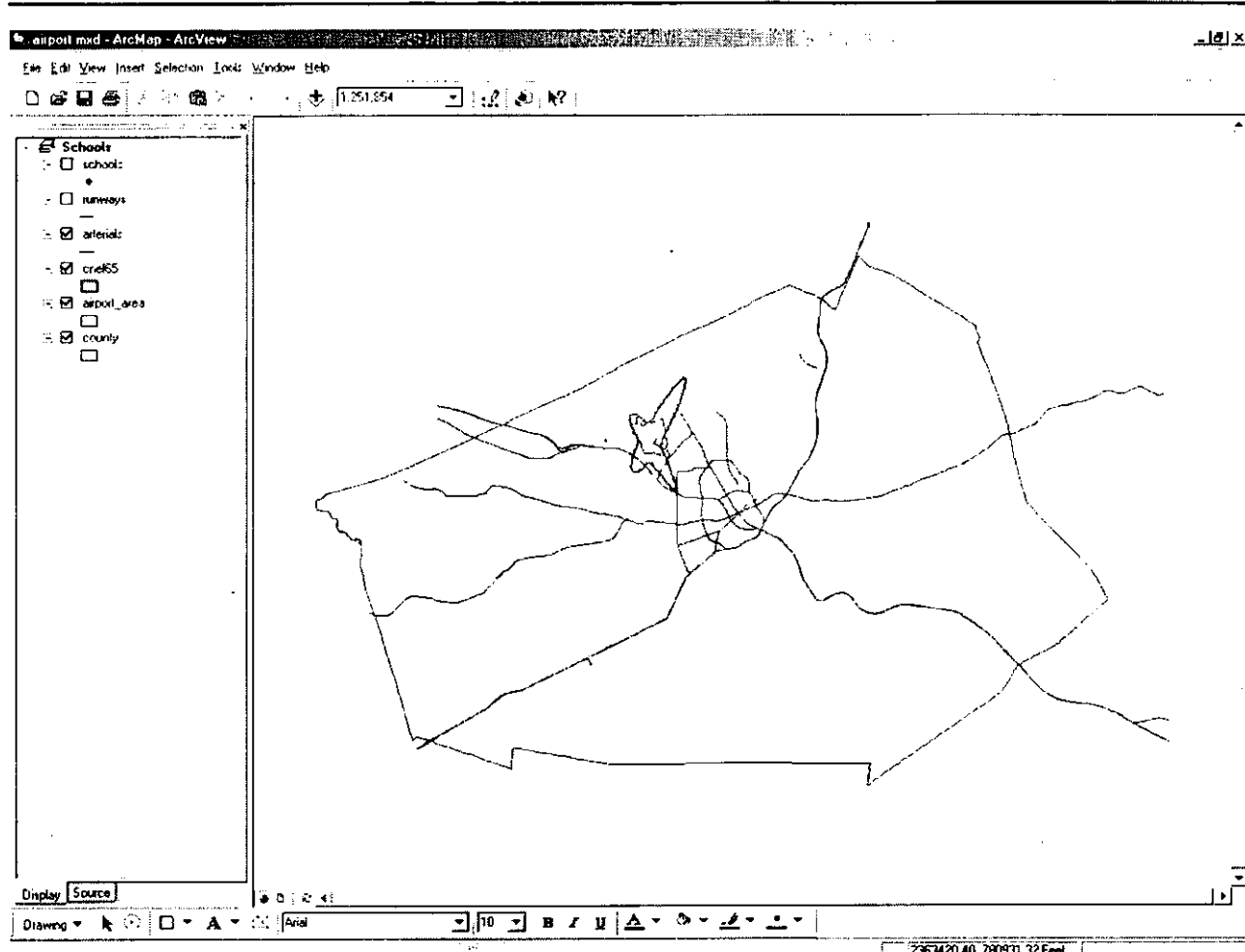


Figure 1.2

IRRIGATION PATCH EDIT

When an Irrigation survey is carried out at the WTG level, the application caption will read "IIT Water Survey – Water WTG". As for the Crop survey, this caption will be modified according to the level of survey undertaken.

The method of editing patches, ie splitting or merging patches, and modifying patch data will be the same as for Crop surveys. However, selecting one or more water patches will be done using the native functions available in ArcMap ie by pressing Shift and clicking the required patches with the left mouse button.

The detail level of the survey will determine what irrigation data is stored in the irrigation feature class. If the level is to ValveID then, the Valve ID along with default and optional fields will be stored alongside the PatchID and if the level is to Irrigation Systems, then the Irrigation System only will be stored alongside the PatchID.

DATA EXPORT

The IIT will provide a facility for the users to export data in .dbf (dBASE) format, .shp (Shape file) and comma delimited text format. Two options will be provided:

- IIT Standard – for the export of data for all default fields
- IIT All – for the export of data for all defaults fields and the selected optional fields.

This facility will be provided from the Tools menu from a command item called "Export Data". A dialog box will be displayed, allowing the selection of a feature class and an options list for the selection of a data format. The data will be automatically saved in the standard C:\IIMSsurveys\Current\exports folder which in itself will be created when the IIT.exe is first installed.

PROPERTY PLANS

The IIT will provide the ability for users to print a property plan. The property plan will consist of two pages. One page will display a photograph of the property and the second will display a grid of crop patch data. Users will have the ability to print to both A4 and A3 paper, either in portrait or landscape orientation.

The layout of both the photograph and the data page will depend on the user printer selections. The photograph page will include the property name, survey date, photo date, a scale bar, and possibly an organisation logo. The data page will include at least default data in addition to user-selected data. If the table is too wide for the selected page orientation, eg portrait, then the printout will be forced onto the alternative orientation ie landscape for print out.

A surveyor will also have the ability to save a property plan as an electronic file, in a format native to ArcView eg. .TIFF. This function will be provided by a pop-menu that will be raised when the user right clicks on the property plan.

SET UP

The installation of IIT.exe will require the below listed actions to take place. These actions will automatically be performed by a separate application called SETUP.EXE.

- Creation of the "wue" folder in the System32 folder
- Placement of "Survey.mxd" in the "wue" folder
- Registration of the comIIT.dll
- Running of a Plugin executable to allow ArcMap to use .ecw files
- Installation of APEX True DB Grid
- Creation of several folders and subfolders
 1. C:\IIMSsurveys
 2. C:\IIMSsurveys\Current
 3. C:\IIMSsurveys\Current\orthophoto
 4. C:\IIMSsurveys\Current\textdocs
 5. C:\IIMSsurveys\Current\exports
 6. C:\IIMSsurveys\Current\propertyplans
 7. C:\IIMSsurveys\Current\databasebackup

Before a survey takes place, the personal survey geo-database will need to be placed in the C:\IIMSsurveys\Current on the surveyors' laptop. This database will then be copied to the "wue" folder of the System32 folder and will become the live personal geo-database.

REVISION HISTORY

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- Document Revision
- Revision Date
- Changes as requested by Dan Meldrum (DEH) in the e-mail dated 05/02/02

Version 1.04 04 Feb 2002

- Document Revision
- Revision Date
- Changes as requested by Dan Meldrum (DEH) in the e-mail dated 01/02/02

Version 1.03 23 Jan 2002

- Document Revision
- Revision Date
- All sections except Introduction and Logon
- Added Set up section

Version 1.02 10 Jan 2002

- Document Revision
- Revision Date
- Logon Section – name of IIT
- Introduction – added last line to third paragraph
- Survey Set up Section – added more information on UserID, removed information about edit and display scales
- Property and Maintenance Section – deleted Properties Details Form subsection. This information was placed in main section. Modification of Figure 1.0, Modification of zooming operations in second paragraph.
- Irrigation Survey – user changed to administrator

- Crop Patch Edit - added subsections Property Patches Verification and Crop Patch Data Form.
- Irrigation Patch Edit – modification of last 2 sentences in second paragraph.
- Property Plans – addition of last 2 lines.

Version 1.01 20 Dec 2001

- Document Revision
- Revision Date
- Almost every section

Version 1.00 11 Dec 2001

- Document Revision
- Revision Date

6 - TECHNICAL SPECIFICATION FOR THE IIT



Dept for Environment and Heritage

Irrigation Inventory Tool

Technical Specification

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CLIENT ACCEPTANCE & SIGN-OFF

I have read this document and agree that it describes the scope of the project.

Signature

Date/...../.....

Name

Position

2. INTRODUCTION

The Irrigation Inventory Tool (IIT) will be used to collect base information on crops and irrigation systems at the property and patch levels. The IIT will be a GIS based tool utilising ESRI's ArcGIS Software to allow the capture of accurate spatially based information on crop types and irrigation. An application will be developed to load a customised version of ESRI's ArcView software that will provide the functionality required by the Department for Environment And Heritage. IIT will use a customised .mxd file and dlls, developed using the VBA supplied with ArcView and Visual Studio 6.0.

Anything described in this specification that upon further investigation is found not to be supported by ESRI's ArcView 8.1 software will be excluded from the IIT. An alternative method to provide similar functionality may be provided.

OVERVIEW

This specification is composed of two main sections.

1. The first will describe the database design
2. The second will describe the customisation of ArcMap to create the IIT

DATABASE DESIGN

IIT will be developed using Microsoft Access 2000 for the personal geo-database. Survey geo-databases will be set up by IIT only if the template geo-database has the .mdb format. No support will be provided for SDE databases in the IIT. The template database will consist of 15 non-feature class tables. The design of each table can be seen below:

Database Tables

All tables will have a "changetimestamp" field to indicate when a field was last changed. The design of the tables will be as follows:

Table Name: tblRegions

PrimaryKey: RegionID

Indexes:

- RegionID

Purpose – contains region details entered by administrator at survey set up and required for logon and layer editing.

Field name	Datatype	Default	Description/Comment
RegionID	Int	Autonumber	Unique number identifying the user
SurveyRegion	Text (50)	Not Null	Survey Region Name
RegionAbbrev	Text (4)	Not Null	Region Abbreviation
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblOrganisations

PrimaryKey: OrgID

Indexes:

- OrgName, OrgAcronym, SurveyYear

Purpose – contains organisation details, entered by administrator at survey set up.

Field name	Datatype	Default	Description/Comment
OrganisationID	Int	Not Null	Unique number identifying the Organisation
RegionID	Int	Not Null	Foreign Key to RegionID in tblRegions
OrgName	Text (50)	Not Null	Organisation Name
OrgAcronym	Text (10)	Not Null	Organisation Acronym
OrgLogo	OLE Object	Not Null	Organisation Logo to be included on the Page Layout.
ClientName	Text (50)	Not Null	Client Name
ClientAcronym	Text (10)	Not Null	Client Acronym
ClientLogo	OLE Object	Null	Clients Logo to be embedded on the Page Layout.
SurveyYear	Int	Not Null	Year in which the survey database is created
SurveyorNumbers	Int	1	Number of Field Surveyors in the region
LandCover	Text (20)	Horticulture	The type of land cover eg Horticulture, Broad Acre
WTGID	Int	3	Foreign Key to WTGID of tblWaterToGround. 3, in this case, refers to "Outlet"
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblUsers

PrimaryKey: UserID

Indexes:

- UserID, UserName

Purpose – contains user details entered by administrator at survey set up and required for logon and layer editing.

Field name	Datatype	Default	Description/Comment
UserID	Int	Autonumber	Unique number identifying the user
OrganisationID	Int	Not Null	Foreign Key to OrgID on tblOrganisations
UserName	Text (20)	Not Null	Name of the user
Password	Text (20)	Not Null	Password of user
LoggedIn	Yes/No	No	Indicates what user has logged on to the system. Used internally so we know who has edited which fields for a property.
MinUnallocatedID	Int	Null	The lowest number in the PropertyID range that will be used for unallocated PropertyIDs
MaxUnallocatedID	Int	Null	The highest number in the PropertyID range that will be used for unallocated PropertyID
SurveyCreatedBy	Text (50)	Null	Name of administrator who created the survey database
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblProperties

PrimaryKey: PropertyID, RegionID

Indexes:

- PropertyID, RegionID, ContactLastName

Purpose – contains property details, entered by surveyor before carrying out a survey.

Field name	Datatype	Default	Description/Comment
PropertyID	Text (5)	Not Null	Unique number identifying the Property. This will be obtained from the base patch.
RegionID	Int	Not Null	Foreign Key to RegionID on tblRegions
LandHolder	Text (50)	Null	Land Holder Name
CompanyName	Text (50)	Null	Name of the Company that owns the property
TradingName	Text (50)	Null	Trading Name of property
ContactFirstName	Text (50)	Null	Contact First Name
ContactLastName	Text (50)	Null	Contact Last Name
Address1	Text (50)	Null	Address1 of property
Address2	Text (50)	Null	Address2 of property
City	Text (50)	Null	City/Town name of property
State	Text (50)	Null	State of property
PostCode	Text (10)	Null	Post code of property
PhoneNumber	Text (20)	Null	Phone Number of contact
MobileNumber	Text (20)	Null	Mobile Number of contact
EmailAddress	Text (50)	Null	E-mail address of contact
DataContributer	Text (10)	Null	Company Name
MeterRF	Text (15)	Random	Meter Reading Frequency eg. Random, Each Irrigation
PumpedArea	Text (4)	None	Pumped Area eg. None, All, Part

IrrigMgmtTraining	Yes/No	No	Irrigation Management Training
FurtherTraining	Yes/No	No	Further Training Interest
KickStartID	Text (10)	Null	Sunrise21 Program
FirstSection	Text (5)	Null	Section cadastral reference
SecondSection	Text (5)	Null	Section cadastral reference
ThirdSection	Text (5)	Null	Section cadastral reference
FourthSection	Text (5)	Null	Section cadastral reference
FifthSection	Text (5)	Null	Section cadastral reference

SixthSection	Text (5)	Null	Section cadastral reference
SeventhSection	Text (5)	Null	Section cadastral reference
EighthSection	Text (5)	Null	Section cadastral reference
NinthSection	Text (5)	Null	Section cadastral reference
TenthSection	Text (5)	Null	Section cadastral reference
EleventhSection	Text (5)	Null	Section cadastral reference
TwelfthSection	Text (5)	Null	Section cadastral reference
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblLocatingWater

PrimaryKey: WTGID

Indexes:

- WTGID, WTGName

Purpose – contains method of locating water names. These names will include Bulk Licence, Private Licence, Outlet and Meter

Field name	Datatype	Default	Description/Comment
WTGID	Int	Autonumber	Unique number identifying the method of locating water to ground.
WTGName	Int	Not Null	Method of Locating Water or Name of Water to Ground type
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblCropTypeList

PrimaryKey: CropID

Indexes:

- CropID, CropType

Purpose – contains crop type details. This information will be imported to the first template database and will be available in all proceeding survey and template databases.

Field name	Datatype	Default	Description/Comment
CropID	Int	Not Null	Unique Crop Code Number
CropType	Text (30)	Not Null	Name or Type of Crop.
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblCropCategoryList

PrimaryKey: CategoryID, CropID

Indexes:

- CategoryID, CropID, CategoryName

Purpose – contains crop category details. This information will be imported to the first template database and will be available in all proceeding survey and template databases.

Field name	Datatype	Default	Description/Comment
CategoryID	Text (2)	Not Null	Unique Category Code Number
CropID	Int	Not Null	Foreign Key to CropID field of tblCropTypeList
CategoryName	Text (30)	Not Null	Name of Category
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblCropVarietyList

PrimaryKey: VarietyID, CategoryID

Indexes:

- VarietyID, CategoryID, VarietyName

Purpose – contains crop variety details. This information will be imported to the first template database and will be available in all proceeding survey and template databases.

Field name	Datatype	Default	Description/Comment
VarietyID	Text (4)	Not Null	Unique Variety Code Number
CategoryID	Text (2)	Not Null	Foreign Key to Category ID field of tblCropCategoryList
VarietyName	Text (30)	Not Null	Name of Variety
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblCropRootstockList

PrimaryKey: RootstockID, VarietyID

Indexes:

- CropRootstockID, VarietyID, CropRootstockName

Purpose – contains crop rootstock details. This information will be imported to the first template database and will be available in all proceeding survey and template databases.

Field name	Datatype	Default	Description/Comment
CropRootstockID	Text (4)	Not Null	Unique Variety Code Number
VarietyID	Text (2)	Not Null	Foreign Key to VarietyID field of tblCropVarietyList
CropRootstockName	Text (30)	Not Null	Name of Rootstock
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblCropFieldsTemplate

No Primary Keys or Indexes.

Purpose – contains no data. This table allows fields to be added, using ArcObjects, to the crop feature class.

Field name	Datatype	Description/Comment
PatchID	Text (2)	Unique Identifier of Patch
PropertyID	Text (10)	PropertyID from Ortho layer or entered
RegionID	Int	RegionID obtained from tblRegions
CropID	Int	Crop Code Number obtained from Crop Code List
CropCategoryID	Int	CropCategoryID obtained from tblCropCategoryList
CropVarietyID	Int	CropVarietyID obtained from tblCropVarietyList
CropRootstockID	Int	CropRootstockID obtained from tblCropRootstockList
AreaHa	Long	Area Hectares. This is the Shape_Area divided by 10000
YearPlanted	Datetime	Year in which the crop was planted
ReworkYear	Datetime	Year of rework
Interplanted	Yes/No	Whether or not crop was interplanted
CropUse	Text (20)	Outcome of production eg cannery, dried fruit
GroundCover	Text (10)	Cover over ground eg bare, mulching
CanopyCover	Int	Derived from Year Planted and Crop Type can be 20, 50, 70
TreeCount	Long	Number of trees
Yield	Decimal (6,1)	Yield obtained from crop
RowSpacingMetres	Decimal (5,2)	Space between rows in metres
PlantSpacingMetres	Decimal (5,2)	Space between plants in metres
TreeCalculation	Long	Tree calculation is determined using formula: Area (ha) divided by Row Spacing (m) divided by Plant Spacing (m)
Clone	Text (30)	Sub variety
TrellisType	Text (20)	Trellis Type
TrellisHeight	Decimal (5,2)	Height of Trellis
TrellisWidth	Decimal (5,2)	Width of Trellis
HarvestingMethod	Text (15)	Method of harvesting
PruningMethod	Text (15)	Method of pruning
Maturity	Text (10)	Maturity of crop eg young, adolescent or mature

Field name	Datatype	Description/Comment
InterplantedTypeID	Int	Crop Code Number obtained from Crop Code List
InterplantedCategoryID	Int	CropCategoryID obtained from tblCropCategoryList
InterplantedVarietyID	Int	CropVarietyID obtained from tblCropVarietyList
InterplantedYearPlanted	Datetime	Year in which the interplant was planted
InterplantedRootstockID	Text (30)	CropRootstockID obtained from tblCropRootstockList
InterplantedReworkYear	Datetime	Year of rework
InterplantedCropUse	Text (20)	Outcome of production eg cannery, dried fruit
InterplantedCanopyCover	Text (2)	Derived from Year Planted and Crop Type can be 20, 50, 70
InterplantedTreeCount	Long	Number of trees
InterplantedYield	Decimal (6,1)	Yield obtained from interplant
InterplantedRowSpaceMetres	Decimal (5,2)	Space between rows in metres
InterplantedPlantSpaceMetres	Decimal (5,2)	Space between plants in metres
InterplantedTreeCalculation	Long	How the tree numbers are calculated eg AreaHa
InterplantedClone	Text (30)	Sub variety
InterplantedTrellisType	Text (20)	Trellis Type
InterplantedTrellisHeight	Decimal (5,2)	Height of Trellis
InterplantedTrellisWidth	Decimal (5,2)	Width of Trellis
InterplantedHarvestingMethod	Text (15)	Method of harvesting
InterplantedPruningMethod	Text (15)	Method of pruning
InterplantMaturity	Text (10)	Maturity of crop eg young, adolescent or mature
ChangeTimeStamp	Datetime	Change date time stamp of data

**May not require this table

Table Name: tblCropFieldsAttributes

PrimaryKey: FieldAttributeID

Indexes:

- FieldAttributeID, FieldName, CompletionType

Purpose – contains crop fields' attributes details. This information will be required for survey set up purposes

Field name	Datatype	Default	Description/Comment
FieldAttributeID	AutoNumber	Not Null	Unique Identifier for the record
FieldName	Text (50)	Not Null	Name of the Crop Field. This is the same as used in tblCropFieldsTemplate
DetailCropType	Yes/No	No	Whether or not field is used in the set up of a Crop Type Detail Survey
DetailCropVariety	Yes/No	N	Whether or not field is used in the set up of a Crop Variety Detail Survey
DetailCropRootstock	Yes/No	No	Whether or not field is used in the set up of a Crop Rootstock Detail Survey
CompletionType	Text (10)	Mandatory	Whether or not field needs to be completed on survey. This will be either Mandatory or Optional
Collection	Text (10)	Default	Whether a field is Default or Optional when made part of a feature class
IsSelected	Bit	No	Whether or not a field has been selected for the current survey. Only applies to the optional fields.
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

****May need template tables – feature classes may be modified by using the IFieldEdit. If so, then will need to include Default field in above table.**

Table Name: tblWaterFieldsTemplate

No Primary Keys or Indexes.

Purpose – contains no data. This table allows fields to be added, using ArcObjects, to the crop feature class.

Field name	Datatype	Description/Comment
WaterPatchID	Text (5)	Unique identifier for the Water Patch
WTGID	Int	WTGID obtained from tblLocatingWater
WTGAlias	Long	WTGAlias Number. The number entered will depend on the WTGID eg Bulk Licence, Outlet
IrrigationSystemType	Text (15)	Irrigation system type eg Pivot, Flood
ValveNumber	Text (3)	Automatically generated by IIT (coding of 000, 001, etc)
YearInstalled	DateTime	The year in which the Irrigation was installed
Drained	Yes/No	Whether the irrigation is drained or not
DrainageSystem	Text (15)	Drainage system used eg Sub-surface, surface
DrainageDisposal	Text (15)	Type of drainage disposal eg. Comprehensive, bore
IDMP	Text (2)	Whether or not and Irrigation Drainage Management Plan is employed
DrainageHazardType	Text (15)	Drainage hazard type eg waterlogging, salinisation
SchedulingMethod	Text (20)	Method used to schedule irrigation eg own experience, soil moisture monitoring
SoilMoistureMonitoring	Text (20)	Method used for soil moisture monitoring eg. Gypsum Blocks, C-Probe
TestWells	Int	Number of wells that exist on property
Pumped	Yes/No	Whether or not water is pumped on the property
ChangeTimeStamp	Datetime	Change date time stamp of data

****May not require this table**

Table Name: tblWaterFieldsAttributes

PrimaryKey: FieldAttributeID

Indexes:

- FieldAttributeID, FieldName, CompletionType

Purpose – contains irrigation fields' attributes details. This information will be required for survey set up purposes

Field name	Datatype	Default	Description/Comment
FieldAttributeID	AutoNumber	Not Null	Unique Identifier for the record
FieldName	Text (50)	Not Null	Name of the Crop Field. This is the same as used in tblCropFieldsTemplate
DetailWaterToGround	Yes/No	No	Whether or not field is used in the set up of a Water To Ground Detail Survey
DetailIrrigationSystems	Yes/No	No	Whether or not field is used in the set up of a Irrigation System Detail Survey
DetailValveUnit	Yes/No	No	Whether or not field is used in the set up of a Valve Unit Detail Survey
CompletionType	Text (10)	Mandatory	Whether or not field needs to be completed on survey. This will be either Mandatory or Optional
Collection	Text (10)	Default	Whether a field is Default or Optional when made part of a feature class
IsSelected	Bit	No	Whether or not a field has been selected for the current survey. Only applies to the optional fields.
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

****May need template tables – feature classes may be modified by using the IFieldEdit. If so, then will need to include Default field in above table.**

Table Name: tblZoomScales

PrimaryKey: ScaleID

Indexes:

- ScaleID

Purpose – contains scale information for display and edits

Field name	Datatype	Default	Description/Comment
ScaleID	AutoNumber	Not Null	Unique Identifier for the record
CropDetail	Int	Null	Detail level of the Crop Survey
WaterDetail	Int	Null	Detail level of the Water Survey
LandCover	Text (20)	Null	Description of Land Use. Eg. Horticulture or Broad Acre
MinScale	Long	Null	Minimum Scale allowed (ie most it can be zoomed out to)
MaxScale	Long	Null	Maximum Scale allowed (ie most it can be zoomed in to)
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblLookUp

PrimaryKey: ItemGroup, ItemCode

Indexes:

- ItemGroup, ItemCode, ItemValue

Purpose – contains look up details. This information will be used to fill some pick or drop down lists on the interface and to fill some fields of records in other tables.

Field name	Datatype	Default	Description/Comment
ItemGroup	Text (50)	Not Null	Field which describes or groups the Item Code eg Crop
ItemCode	Text (50)	Not Null	Field which describes or groups the Item Value eg Ground Cover
ItemValue	Text (100)	Null	Value to be looked up eg. Bare
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Table Name: tblCanopyCover

PrimaryKey: CropID, Age

Indexes:

- CropID, Age

Purpose – contains canopy cover default values

Field name	Datatype	Default	Description/Comment
CanopyCoverID	Int	Not Null	Unique identifier for the record
CropID	Int	Not Null	Foreign Key to CropID of tblCropTypeList
YearPlanted	Text (5)	Not Null	Year in which the crop was planted.
CanopyCover	Int	Null	Canopy Cover in percentage eg 20, 50
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

Feature Class

Names as listed in the table below:

Survey Detail Level	Feature Class Name
Crop Type	fcCropType
Crop Variety	fcCropVariety
Crop Rootstock	fcCropRootstock
Crop Type And Water WTG	fcCropTypeWaterWTG
Crop Type And Water Irrigation Systems	fcCropTypeWaterIrrigationSystems
Crop Type And Water Valve Unit	fcCropTypeWaterValveUnit
Crop Variety And Water WTG	fcCropVarietyWaterWTG
Crop Variety And Water Irrigation Systems	fcCropVarietyWaterIrrigationSystems
Crop Variety And Water Valve Unit	fcCropVarietyWaterValveUnit
Crop Rootstock And Water WTG	fcCropRootstockWaterWTG
Crop Rootstock And Water Irrigation Systems	fcCropRootstockWaterIrrigationSystems
Crop Rootstock And Water Valve Unit	fcCropRootstockWaterValveUnit

PrimaryKey: None

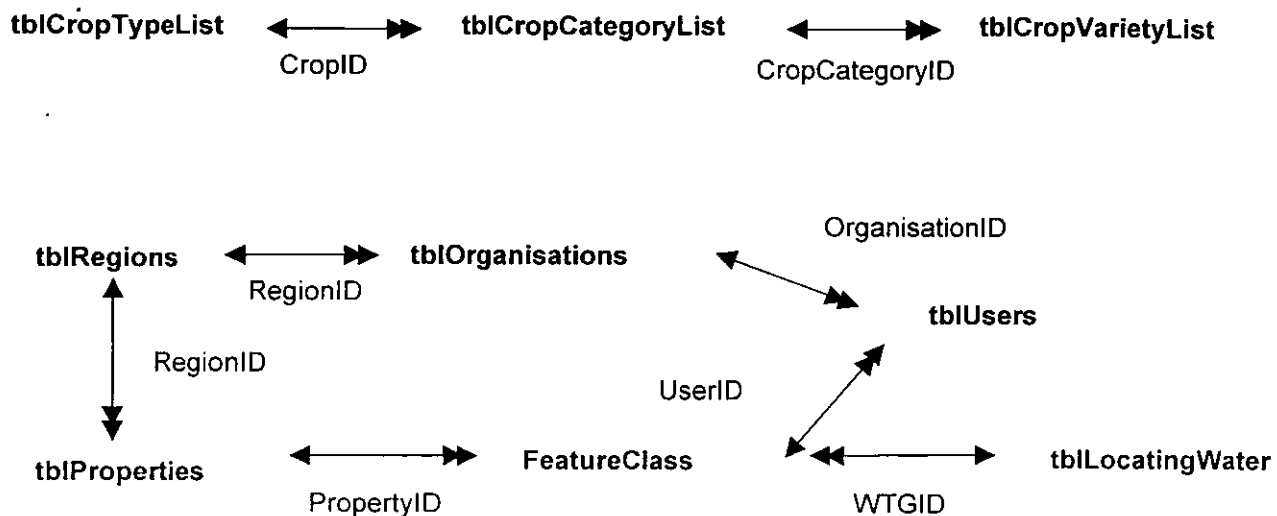
Indexes:None

Purpose – all fields listed below will be present in the all feature classes for crop editing. The additional fields added depend on the detail selected at survey set up.

Field name	Datatype	Default	Description/Comment
OBJECTID	AutoNumber	Not Null	Unique Identifier for the record
SHAPE	OLE OBJECT	Not Null	Automatically generated when a feature class is created
SHAPE_Length	Double	Not Null	Automatically generated when a feature class is created
SHAPE_Area	Double	Not Null	Automatically generated when a feature class is created
PropertyID	int	Not Null	Foreign Key to PropertyID on tblProperties
PatchID	Int	Not Null	PatchID – automatically generated by IIT
WaterPatchID	Text (5)	Not Null	If the Feature Class has Water Data then this field exists and will be automatically generated by the IIT.
AreaHectares	Decimal (8,1)	Not Null	Area of patch in hectares
UserID	Int	Not Null	Foreign Key to UserID of tblUsers
ChangeTimeStamp	Datetime	Currentdate	Change date time stamp of data

ENTITY-RELATIONSHIP DIAGRAM

The diagram below illustrates how the tables, as described above, will be related to each other.



Standalone Tables

tblLookUp
tblCropFieldsTemplate
tblCropFieldsAttributes

tblZoomScales
tblWaterFieldsTemplate
tblWaterFieldsAttributes

tblCropRootstockList
tblCanopyCover

LOGON

When a user runs IIT.exe, a dialog box will be displayed, requiring the entry of a Username and Password. If no Username or password is entered or an incorrect Username or password is entered, then a warning will be displayed and the user will be prevented from accessing IIT. If a user logs on as "Administrator" and the correct password is entered (as crosschecked against hard code) then the IIT will be opened with the full suite of administrative functions available.

If a user enters a Username other than "Administrator" then the Username and Password will be crosschecked with those names that exist in tblUsers of the live database. If the logon details are valid, IIT will be opened with no administrative functions available but with all functions necessary to perform a survey.

DATABASE BACKUPS

When IIT opens, after a valid login, it will shell out to ArcMap.exe and pass in a command line containing a path to a customized .mxd file called "Survey.mxd". This .mxd file will reside alongside the live database in the "wue" folder of System32. Survey.mxd will be designed so it can only be opened by the IIT. If ArcMap is used to open Survey.mxd, a Password dialog box will be displayed requiring the entry of a user name and password and if invalid details are entered, the application will revert to Normal.mxd.

If a live geo-database exists in the "wue" folder, and the extension of the file is .srg, (on exiting IIT, the live database will have its extension changed to.srg.) it will be converted to .mdb file. After extension conversion, the live geo-database will be copied, and placed in the C:\IIMSuveys\Current\databasebackup standard survey folder. Two backup geo-databases will be maintained by the System. The latest copy of the live geo-database will be copied over the oldest backup .mdb file in the Backup folder.

DATABASE RESTORATION

An administrator will have the ability to restore the live database. If the live database becomes corrupt, the "Restore" menu item will allow the administrator to browse to another .mdb file and restore. This will automatically place the selected database in the "wue" folder of System32 and replace the corrupt live database.

SURVEY SETUP

If a user logs on as an administrator they will have the ability via a menu option called "Administrative", as shown in Figure 1.0 below, to set up a survey.



Figure 1.0

The "Administrative" menu

General Information

The administrator will first be required to fill in the "General Information" form, as shown in Figure 1.1 below, which will include Region Name, Organisation Name and Surveyor names.

The screenshot shows a software interface with a map in the background and a 'General Information Survey Setup' dialog box in the foreground. The dialog box has three tabs: 'Organisation Details', 'Admin/Surveyor Names', and 'Client Details'. The 'Organisation Details' tab is active. It contains the following fields and options:

- Region Name: A dropdown menu with 'Metbein' selected.
- Region Abbreviation: A text field with 'MERB'.
- Organisation Name: A text field with 'Fielke Pty Ltd Apicots'.
- Organisation Acronym: A text field with 'Fapi'.
- Organisation Logo: A large empty rectangular box with 'Select Logo' and 'Remove Logo' buttons below it.
- Survey Year: A text field with '2002'.
- Land Cover: A dropdown menu with 'Horticulture' selected.
- Do you want to survey water use as well as crops?: A checkbox that is checked.
- For this survey how will you locate water to ground?: A dropdown menu with 'Private Licence' selected.

At the bottom of the dialog box are 'OK', 'Cancel', and 'Apply' buttons. The background map application has a menu bar (File, Edit, View, Insert, Selection, Tools, Administrative, Window, Help) and a toolbar. A 'Layers' panel on the left lists 'mosaic_natural.ecw', 'RGB Composite', 'Red Band_1', 'Green Band_2', and 'Blue Band_3'. A status bar at the bottom right shows coordinates '448442 77 6211675 23 Meters'.

Figure 1.1

The General Information Survey Set up form.

In the General Information form, if the user checks the "Do you want to do an Irrigation as well as a Crop Survey?" then the "Water To Ground" drop down list will become enabled, allowing this field to be selected for the new survey.

The Client Details tab will provide the ability to add a logo for the client. This logo will be displayed on the lower left hand corner of the Property Plan print out.

Setting the Data Source

Once the General Information form has been completed and saved, two additional menu items, "Set Ortho-Photograph" and "Set Data Source" will become available for use. These items will allow the administrator to select the ortho-photograph that will be used for the new survey and to set the data source for use in creating the new survey database.

If the "Set Data Source" item is selected, a dialog box will be displayed allowing the user to browse to and select a feature class from an Access Database.

If the database contains only "Property" spatial information ie properties which do not have PatchIDs yet assigned, the feature class name will be "fcBasePatch". If the database contains information from a previous survey then the name of the feature class will depend on the detail level of the survey at survey set up. One feature class will be used to hold both Crop and Irrigation Data. The name will be a combination of both crop and water detail levels and these are displayed in the table below:

Survey Detail Level	Feature Class Name
Crop Type	fcCropType
Crop Variety	fcCropVariety
Crop Rootstock	fcCropRootstock
Crop Type And Water WTG	fcCropTypeWaterWTG
Crop Type And Water Irrigation Systems	fcCropTypeWaterIrrigationSystems
Crop Type And Water Valve Unit	fcCropTypeWaterValveUnit
Crop Variety And Water WTG	fcCropVarietyWaterWTG
Crop Variety And Water Irrigation Systems	fcCropVarietyWaterIrrigationSystems
Crop Variety And Water Valve Unit	fcCropVarietyWaterValveUnit
Crop Rootstock And Water WTG	fcCropRootstockWaterWTG
Crop Rootstock And Water Irrigation Systems	fcCropRootstockWaterIrrigationSystems
Crop Rootstock And Water Valve Unit	fcCropRootstockWaterValveUnit

Figure 1.2

Crop Survey

Once the data source has been set, another menu item labelled "Crop" will become enabled and allow the administrator to set the detail level of the Crop Survey. The options available will include:

- Same as Data Source: no form will be displayed. The feature class will be copied directly to the new personal geo-database
- Crop Type: form will be displayed allowing the selection of optional fields. The new feature class will be modified in accordance to the optional fields selected. Depending on the detail level of the selected template feature class, fields may need to be added or deleted after being copied to the new personal geo-database.
- Crop Variety: function as for Crop Type with a greater number of default and optional fields.
- Crop Rootstock: function as for Crop Variety with a greater number of default and optional fields.

An example of the type of form displayed is shown below in Figure 1.4. If the administrator selected "Crop Rootstock" this form will be raised. Different tabs are used to separate default from optional fields.

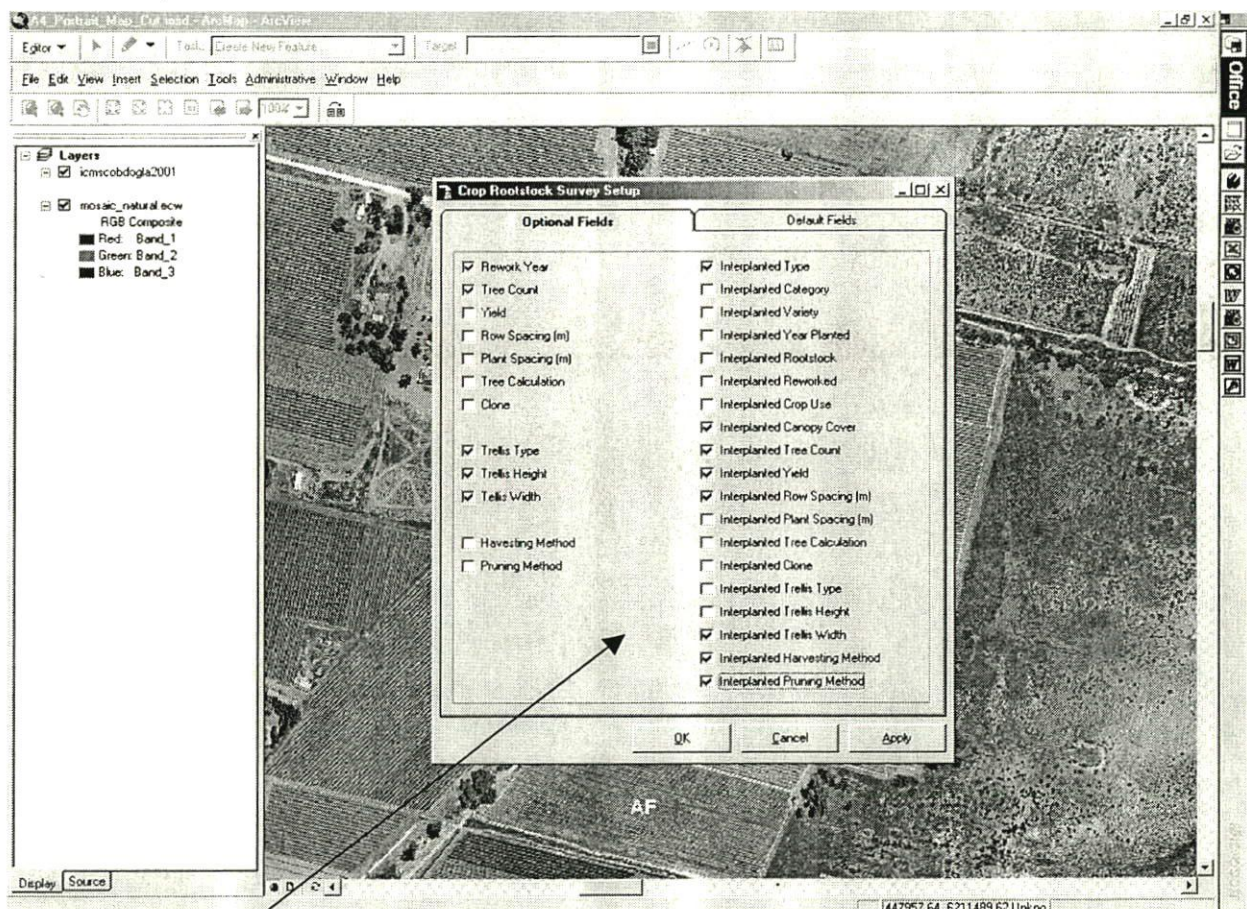


Figure 1.4

Crop Rootstock Survey Set up form that allows administrators to select Optional fields.

The defaults will be available for viewing on a second tab but the administrator will not have the ability to select or deselect these. Both default fields and selected optional fields will be added, if they do not already exist, to the crop feature class on survey creation.

Water Survey

Once the "Crop" detail level and optional fields have been set, the "Water" menu item will become enabled assuming the Irrigation Survey check box on the General Information had been checked. This will allow the administrator to set the detail level of the Irrigation Survey. The options available will include:

- Same as Data Source: no form will be displayed. The feature class will be copied directly to the new personal geo-database
- Water WTG: form will be displayed allowing the selection of optional fields. The new feature class will be modified in accordance to the optional fields selected. Depending on the detail level of the selected template feature class, fields may need to be added or deleted after being copied to the new personal geo-database.
- Water Irrigation Systems: function as for Water WTG with a greater number of default and optional fields.
- Water Valve Unit: function as for Water Irrigation Systems with a greater number of default and optional fields.

The last three of the above options will display a form allowing the selection of optional fields. Default fields will also be displayed on this form but will not be available for selection. If one of the last three options is selected, then the new feature class will be modified in accordance to the optional fields selected.

Create Survey Database

Once the "Water" detail level and optional fields have been set, an additional menu item labelled "Create Survey Database" will become enabled. When this item is selected, the survey database will be automatically created and placed in the C:\IIMSsurveys\Current standard survey folder. This folder will be created by the SETUP.EXE, as described in Section 10. The region abbreviation and current year will be used to define the name of the database file. For example, if the survey has been set up for COBDOGLA and the current year is 2002, then the personal geo-database will have the name "COB_2002.mdb".

As specified above, three detail levels will be available for selection and the level selected will determine the default and optional fields that may be included for editing. The default fields will be automatically included in the feature class whereas the optional fields will be available on a form for selection. Both default fields and selected optional fields will then be added to the feature class on creation of the survey geo-database. UserID and ChangeTimeStamp will also be included as fields to store data on who has modified patch data. UserID will be the foreign key to UserID in the Users Table.

Unallocated PropertyIDs

When the survey personal geo-database is created, the IIT will automatically search the feature class for PropertyIDs that do not exist in the Properties table. New records will be created in the Properties table for those IDs. The IIT will automatically create a range of propertyIDs, for use on unallocated properties, for those Surveyors that have been assigned to the District. The number range assigned will be based on the assumption that a District has no more than 1000 properties and each surveyor will have a unique number range. The numbers ranges assigned to each surveyor will be placed in the Users table.

If a survey has been created from an ortho photograph, where no properties have been defined, then the number range will depend on the number of surveyors for the District. For example, if there are 4 surveyors, then surveyor "A" will have a PropertyID number range from 001 – 250 and surveyor "B" will have a number range from 251-500.

If the survey has been created from a feature class, where some properties have been defined, the IIT will first determine the current maximum PropertyID. The number range assigned to each surveyor will depend on this value to ensure each property has a unique property ID. For example, if the current maximum PropertyID is 560 and there are 4 surveyors, then surveyor "A" will have a number range from 561-670($(1000-560)/4 + 560$). In the calculation of this number range, only integer divisions will be used.

Database Formats

When a survey database is set up, the IIT will only allow a template geo-database to be selected if it is an Access Database. This means that after data from several personal geo-databases have been merged, which may occur after a crop survey for example, the resulting database will need to be personal geo-database in the .mdb format.

PROPERTY SELECTION AND MAINTENANCE

If a user logs on as a surveyor, or administrator, they will have the ability via a "Properties Selection" form, to maintain information for that property, and also to select that property for crop and irrigation patch edits. This form, as shown in Figure 1.5 below will include a search capability and a grid, displaying a list of the properties. A toolbar will provide the ability to move through records, save edited information, add new properties and select a property. On the first occasion, the grid will contain only property IDs. However, on proceeding surveys, it will display additional property information, including Land Holder and Contact Name. If, on survey set up, unallocated PropertyIDs had been added to the Properties table, this form will only display those IDs that are available for use by the logged on user.

The screenshot displays a software interface for property management. The main window is titled 'Properties Maintenance' and features a map in the background. Overlaid on the map is a form with three tabs: 'Properties', 'Property Details', and 'Irrigation Details'. The 'Property Details' tab is currently selected, showing various input fields for property information. To the left of the map is a 'Layers' panel with a tree view showing 'kmrcobdogla2001' and 'notac_natural.ecw' with sub-layers for 'Red Band_1', 'Green Band_2', and 'Blue Band_3'. At the bottom of the map area, there is a status bar displaying coordinates '447935.24 6211061.33' and the text 'Unknown'. A toolbar at the top of the map area contains various icons for navigation and editing.

Figure 1.5

The "Properties Selection" form. This will allow a property to be selected and related information updated. This form includes the MortonBlacketer Pty Ltd Toolbar, which allows the navigation through Property details. Note: This has already been developed and MortonBlacketer Pty Ltd will retain ownership of the intellectual Property for the toolbar.

If the surveyor fails to fill in all mandatory property information, then a warning will be displayed, but they will still have the ability to proceed and save the added or modified data.

When an allocated property is selected, the IIT will zoom to the extent of the property. When a user is performing an edit operation, they also will only have the ability to zoom to an edit scale

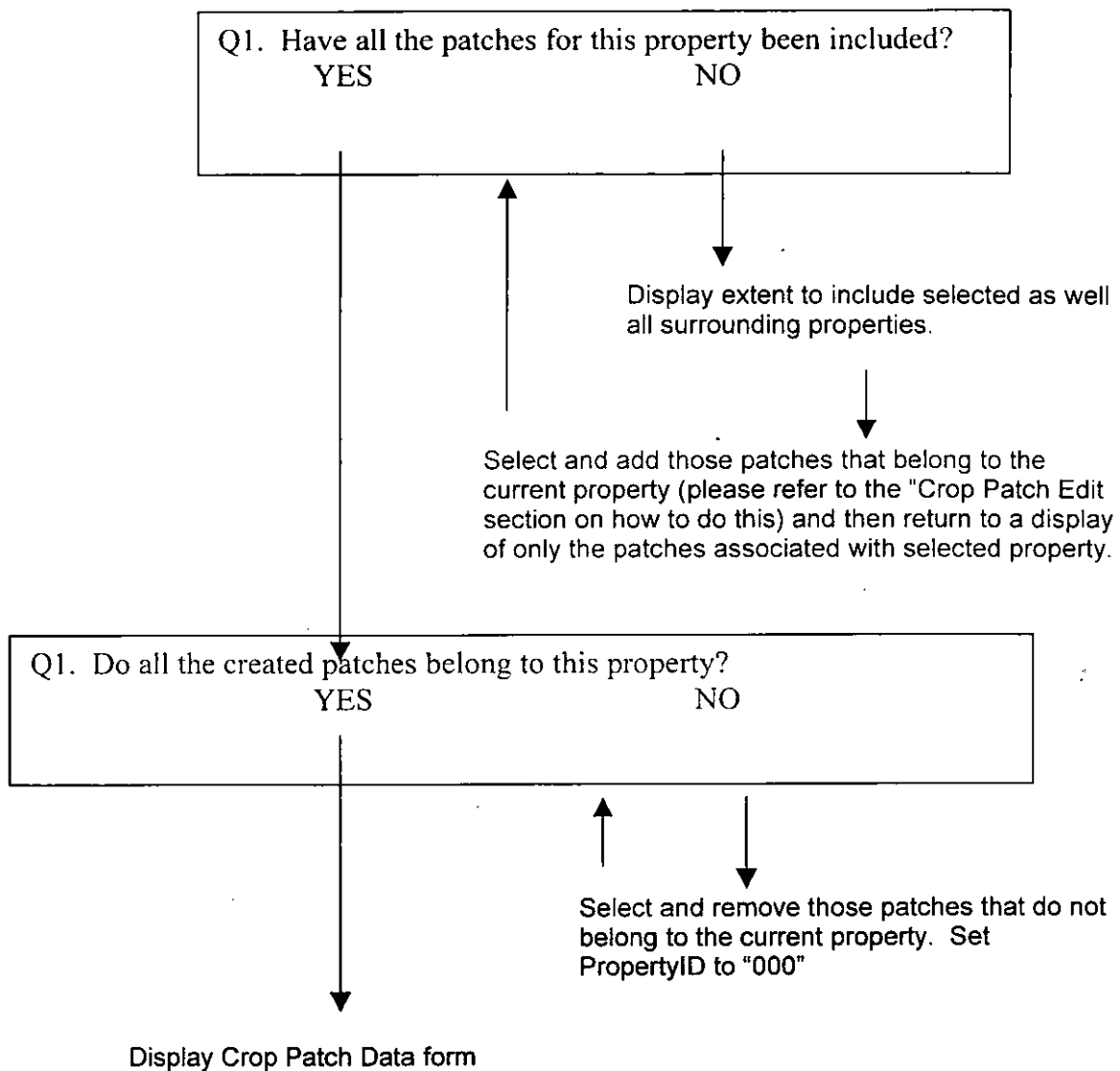
below or greater than that specified in the same table. The scale values used depend on the current detail level. Zooming in and out will also be in increments of 1000.

If the user selects a property that has an unallocated PropertyID, a warning will be displayed and the map will remain at full extent. In this scenario, the unallocated PropertyID will automatically be assigned to newly created Patch features – ie will be displayed in the “Crop Patch Data” form and applied to the feature class if the user clicks Save. This automatic assignment of newly created PropertyIDs to a crop feature classes will continue until the user selects another Property via the “Properties Selection” form.

A user will be required to select a property to enable the “Start Editing” menu item of the Editor Toolbar. This menu item will not be available for use until a property is selected. If a surveyor has finished editing the patches for a property, remains logged on to the system and needs to carry out an additional survey, they will be required to select a new property from the “Properties Selection” form. If the user fails to make another Property selection then the PropertyID for the previous property will be assigned to the crop patches of the new property.

Property Patches Verification

In the IIT, surveyors will have the ability to modify data for multiple crop patches at the same time. They will be able to select one or more patches, right click to display a pop-up menu, the “Map View Context Menu”, and then select “Crop Patch Data” from the list. Before displaying a form to allow the edit of patch data, selecting “Crop Patch Data” will initialise a property patches verification process. This process is illustrated below in Figure 1.6 and will occur the first time “Crop Patch Data” is selected for a property. The process will not be repeated if the user continues to edit the same property. If PropertyID changes, because a new one is selected in the “Properties Selection” then the IIT will re-initialise a PropertyID variable. This means the property patches verification process will again take place, the first time “Crop Patch Data” is selected for a property.



During the process of patch validation, the user will have the ability to add, split and merge patches.

Figure 1.6

Crop Patches will be added and cut/split using methods that pre-exist in ArcView. The Editor toolbar will be available for use via the Tools menu option. There will also be changes to the availability of some commands on the Editor toolbar, as discussed in Section 12 "Menus and Command Item Availability", and to the names of edit tasks.

CROP PATCH EDIT

When a Crop survey is carried out at the Crop Type level, the application caption will read "IIT Crop Survey – Crop Type". This caption will be modified according to the level of survey undertaken.

Editing Crop Patch Features

ArcView allows new polygons to be added or current polygons to be split or merged by selecting the required menu item and performing the required mouse and line movements. Crop patches or polygons will be added, split or merged in IIT as is currently performed in ArcView. The IIT however, will have more appropriate Edit Task menu list names in accordance with the purpose of the tool. The Edit Task menu is displayed in Figure 1.7 below.

PatchID labels will not be displayed on each Patch until the surveyor selects the "Set PatchIDs" menu item from the Selection menu. This menu item will assign unique patchIDs to each patch and then set PatchID to be the Label Field, ensuring that the IDs are displayed on the ortho photograph.

Cutting Crop Patches

When a surveyor needs to cut/split a patch they will be required to select "Split Patches" from the Task combo box ". The Edit Task drop down combo box is displayed below:



Figure 1.7

The Edit Task drop down combo box – Cut Polygons will be renamed to “Split Patches”

If a surveyor cuts a patch and then saves the edit, the new Patch will inherit the PatchID from the initial patch. This PatchID will be modified when the user selects the “Set PatchIDs” menu item.

Creating Crop Patches

When a surveyor needs to create a patch they will be required to select "Create New Patch" from the Task combo box.

If a surveyor creates a new patch and then saves then edit, the new patch will not have a PatchID. A unique PatchID will be assigned when the user selects the "Set PatchIDs" menu item.

Merging Crop Patches

When a surveyor needs to merge two patches they will be required to select the first patch, press Shift down, select the second patch and then select the "Merge" menu item from the "Editor" menu.

If a surveyor merges two patches and then saves the edit, the new patch will take on the attributes of the first patch selected in the process. For example, if PatchID "AF" is selected followed by PatchID "AG", the new Patch will take on the attributes of PatchID "AF". A unique and different PatchID maybe be assigned when the user selects the "Set PatchIDs" menu item.

Other Edit Tasks

Other Edit Tasks, as listed below, in ArcMap will also be renamed. The "Mirror Features" option will not be included with the IIT.

1. ArcMap Edit Task	2. IIT Edit Task Name
Auto Complete Polygon	Auto Complete Patch
Extend/Trim Features	Extend/Trim Patches
Modify Features	Modify Patches
Reshape Feature	Reshape Patch

Snapping Environment And Tolerance

The Snapping Environment for the IIT will, by default, have all switches/check boxes turned on. An example of this is shown below in Figure 1.8. The Snapping Tolerance will be set to 3 pixels.

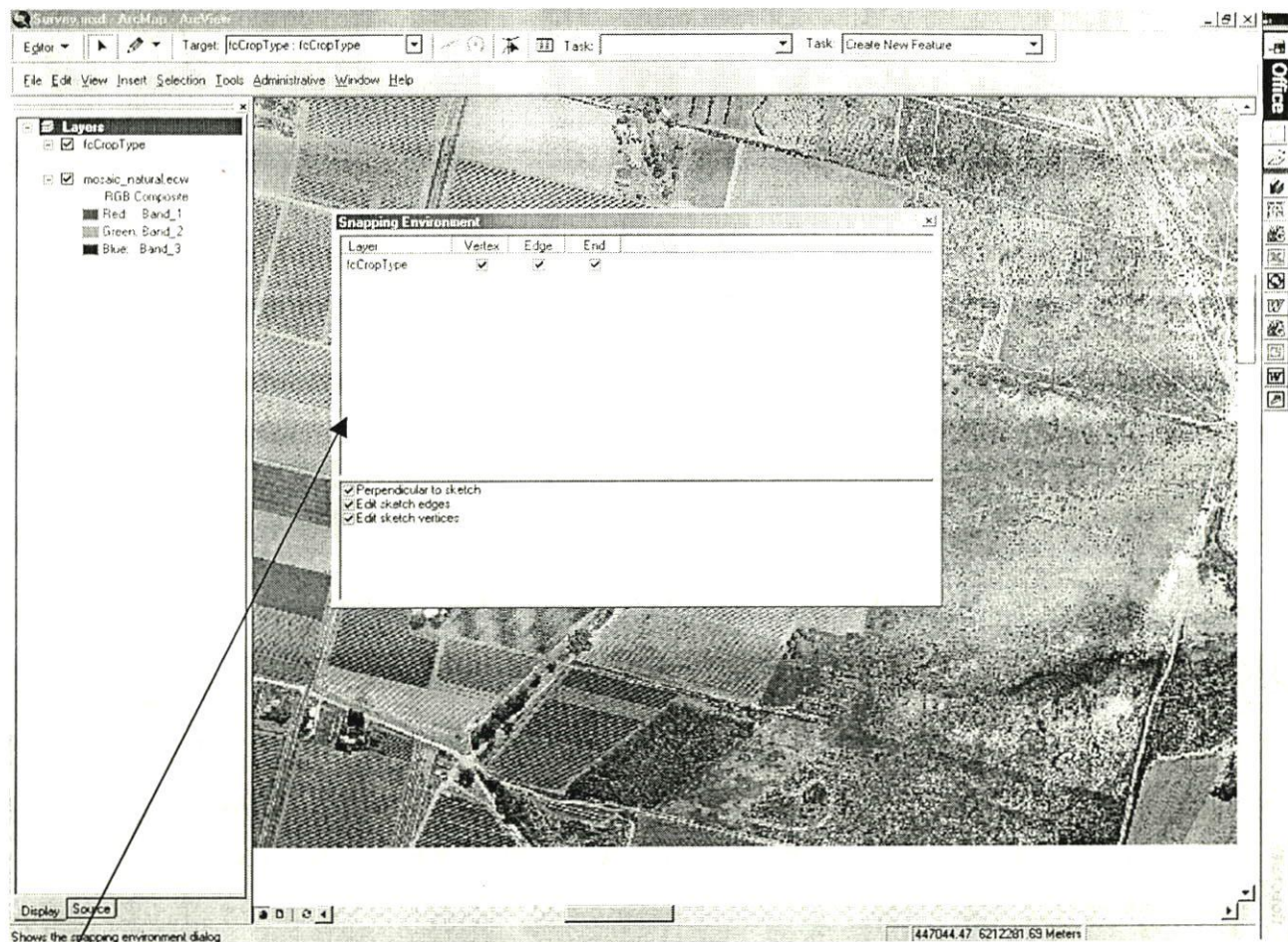


Figure 1.8

The Snapping Environment dialog box.

Crop Patch Data Form

Once the Property Patches Verification Process is complete, the surveyor will have the ability to select a "Crop Patch Data" menu item from the Map View Context Menu. This form will have two tabs, "Mandatory Data" and "Optional Data" and allow the edit of all data required for the Crop Survey. This is shown in Figure 1.9 below.

If the surveyor fails to fill in all mandatory data for the selected patch/s, then a warning will be displayed but they will still have the ability to proceed and apply the added or modified data.

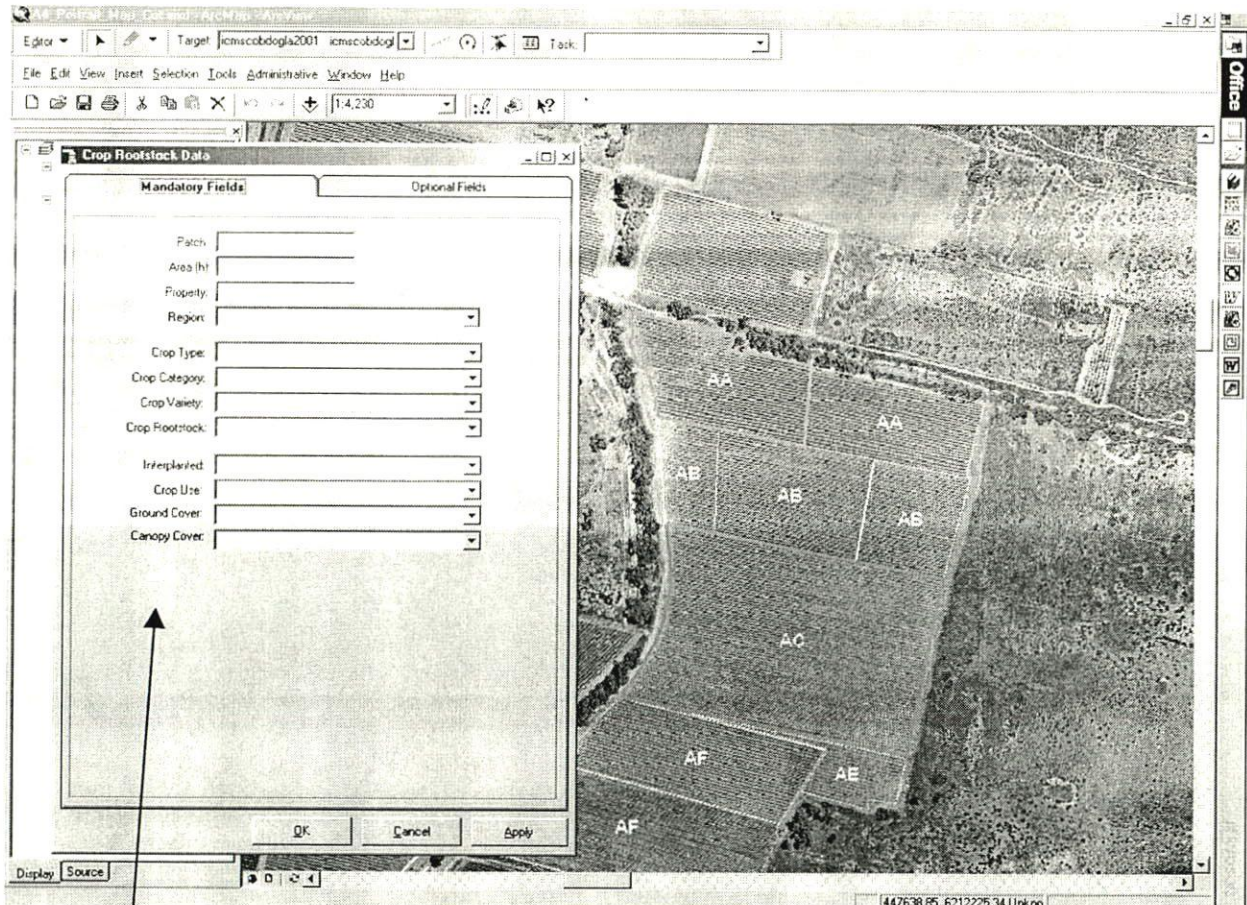


Figure 1.9

The "Crop Patch Data" form.

All patches that have mandatory data filled in will be coloured light green (using hatches) and all patches that do not have all mandatory filled will be coloured light red (using hatches). The light green hatches will have a different hatch pattern than that of the red coloured hatches. This will provide a visual representation of the patches have been analysed by the surveyor.

A surveyor will also have the ability to select one or more crop patches even if Irrigation patches exist on the Property map. If the user is carrying out a Crop Survey, an additional edit command item will be available on the Editor toolbar. When clicked, this command will display a small form allowing the selection of patches based on PatchID. This form is shown below in Figure 2.0.

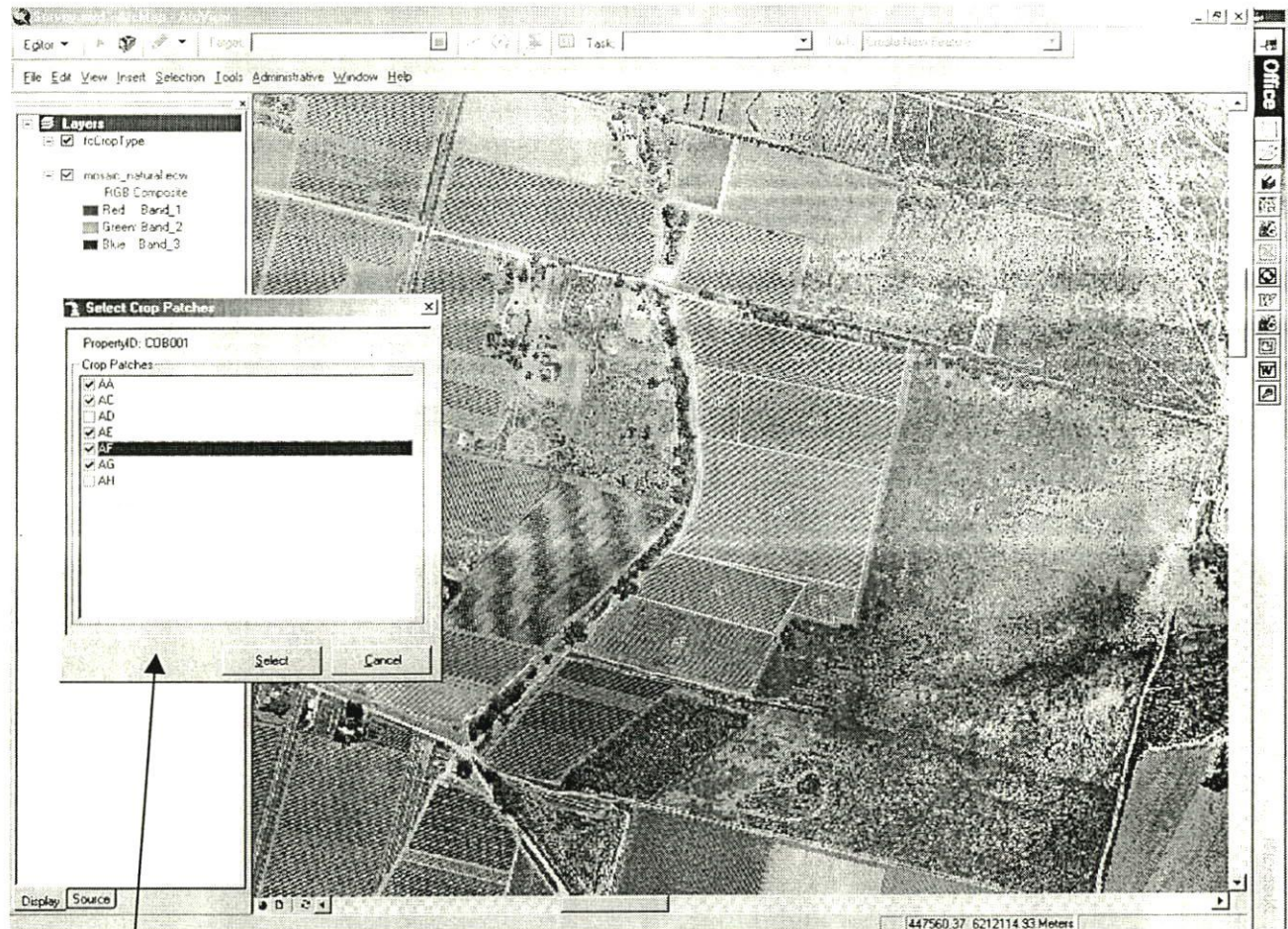


Figure 2.0

The "Select Crop Patches" form that allows the selection of multiple crop patches and displays the PropertyID.

If a user selects two or more patches then not all fields will be available for editing on the "Crop Patch Data" form. PatchID for example, which is unique to each Patch (this will be enforced by the Crop Patch Data form), will have a disabled text box with a grey background. The Area (ha) text box will behave the same as for PatchID. This is shown in Figure 1.6 where two patches have been selected for editing. Crop Type and Crop Use however, which may be the same for multiple patches will be editable.

Layer Display

The Table of Contents or Layers window, which is displayed by default when ArcMap is opened, as shown in Figure 2.1 below, will not be displayed in IIT. However, a user will have the ability to turn on and off layers via a Menu. Layers that are turned on will have a tick to the left hand side of the layer name. Layers that are turned off will not have tick next to their name.



Figure 2.1

Table of Contents.

IRRIGATION PATCH EDIT

When an Irrigation survey is carried out at the WTG level, the application caption will read "IIT Water Survey – Water WTG ". As for the Crop survey, this caption will be modified according to the level of survey undertaken.

The method of editing patches, ie splitting or merging patches, and modifying patch data will be the same as for Crop surveys. The "Irrigation Patch Data" form will also be available via the Map View Context Menu. The detail level of the survey will determine what irrigation data is stored in the feature class. If the level is to ValveID then, the Valve ID, along with the default and optional fields, will be stored alongside the PatchID. If the level is to Irrigation Systems, then the Irrigation System, along with the default and optional fields, will be stored alongside the PatchID. If the level is to WTG, then the WTG<Alias>, along with the default and optional fields, will be stored alongside the PatchID.

DATA EXPORT

The IIT will provide a facility for the users to export data in .dbf (dBASE) format, .shp (Shape file) and comma delimited text format. Two options will be provided:

1. IIT Standard – for the export of data for all default fields
2. IIT All – for the export of data for all defaults fields and the selected optional fields.

This facility will be provided from the Tools menu from a command item called "Export Data". A dialog box will be displayed, allowing the selection of a feature class, the folder into which the data will be exported and an options list for the selection of a data format.

PROPERTY PLANS

The IIT will provide the ability for users to print a property plan. The property plan will consist of two pages. One page will display a photograph of the property and the second will display a grid of crop patch data. Users will have the ability to print to both A4 and A3 paper, either in portrait or landscape orientation. A page set up dialog box; similar to the one raised in ArcView below Figure 2.2, will be used to allow the selection of Standard Page Sizes (A4, A3) and Page Orientation (Portrait, Landscape). The options selected will load a different .mxt file with the required text, picture and scale layouts.

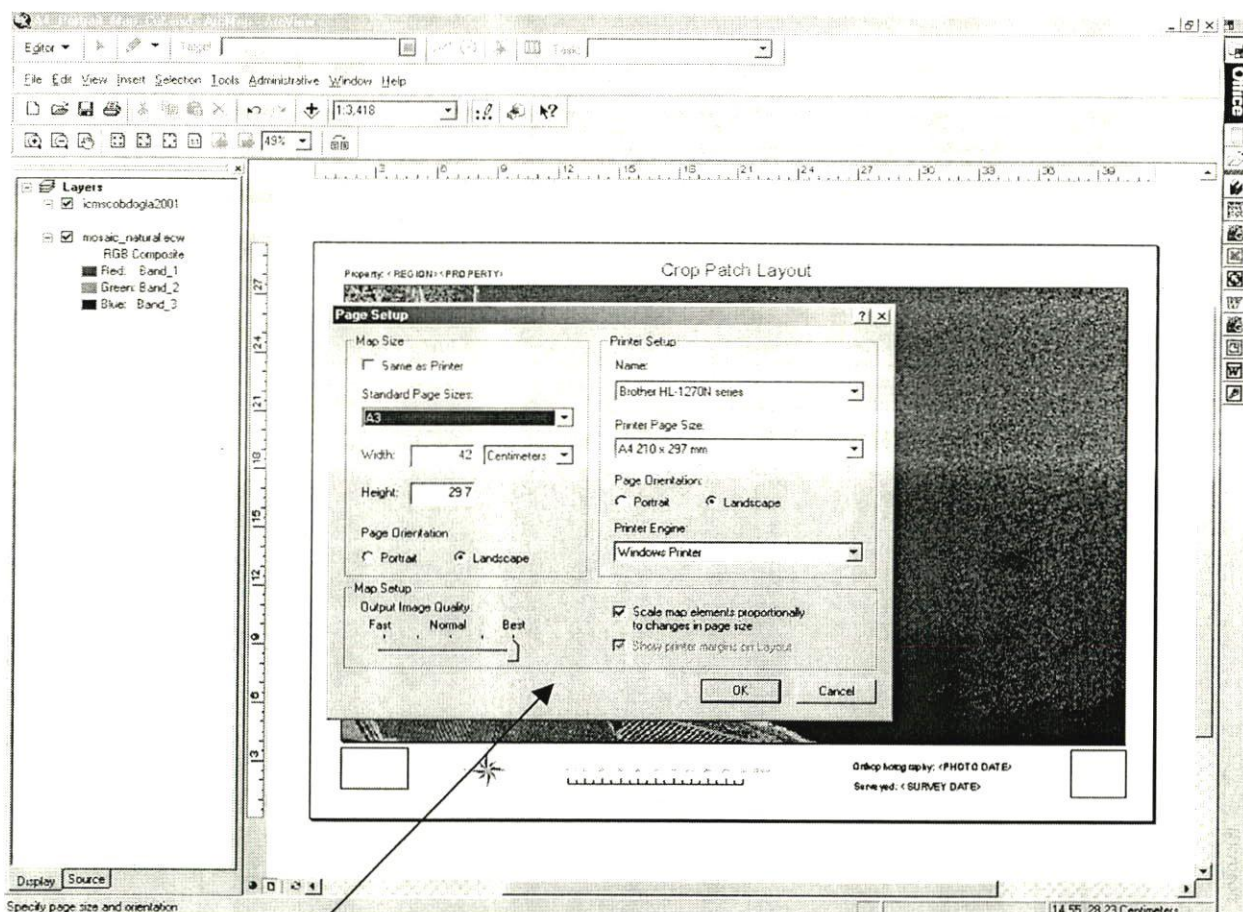


Figure 2.2

The native "Page Setup" form

The photograph page will include the property name, survey date, photo date, a scale bar, a client logo and an organization logo. The data page, also located on a separate .mxt file, will include at least default data in addition to user-selected data. If the table is too wide for the selected page orientation, eg portrait, then the printout will be forced onto the alternative orientation ie landscape for print out. If the table is then too wide for orientation, then multiple pages for the data will be used. The Department of Environment and Heritage will supply templates for page layouts for both property photographs and tables. A surveyor will also have the ability to save a property plan as an electronic file, in a format native to ArcView eg. .TIFF. This function will be provided by a pop-menu that will be raised when the user right clicks on the property plan. The electronic file will be saved to the C:\IIMSsurveys\Current\propertyplans folder. The name of the file will be a concatenation of PropertyID and Survey Year eg COBD001_Survey2002.tiff.

MENUS AND COMMAND ITEM AVAILABILITY

Most menus and command items that are available for use in ArcView will not be available in the ITT. This is to ensure data integrity in the personal geo-database.

Main Menu

The "Main Menu" will have the following menu items and commands removed:

File 3. Menu	New 4. Menu Item
	Open
	Save As
	Add Data
	Add Data From Geography Network
	Map Properties
	Import From ArcView Project
	List of Previous .mxd files (ability to select)
View	Toolbars
	Table of Contents
	Overflow Labels
	Identity Results
	Data Frame Properties
Insert	Data Frame
	Zoom to Selected Features ?
	Set Selectable Layers
Tools	Geo-coding
	Add XY Data
	Add Route Events
	Buffer Wizard
	Geo-processing Wizard
	Arc Catalog
	Macros
	Customize
	Extensions
	Options

Editor Toolbar

The "Editor Toolbar" will have the following menu items and commands removed:

Editor 5. Menu	Integrate 6. Menu Item
	Options
	Command Items
	Attributes
	Split

Page Layout Toolbar

In ArcView, the Page Layout Toolbar is automatically loaded when the active view is changed from Data (Map) to Page Layout. However, when the active view is changed back to Data, the Page Layout toolbar remains displayed. In the IIT, this toolbar will be unloaded in Data View and not all commands will be available for use.

The "Page Layout Toolbar" will have the following command removed:

Command Items
Change Layout

Context Menus

Map View Context Menu

This Menu pops up when the right mouse button is clicked on the Map in Data View.

The "Map View Context Menu" will have the following command items removed:

Add Data 7. Command Items
New Group Layer
Copy
Paste Layer
Remove
Convert Features To Layers
Properties

Page Layout Context Menu

This Menu pops up when the right mouse button is clicked on the Map in Page Layout View.

The "Page Layout Context Menu" will have the following command items removed:

8. Command Items
Change Layout
Paste
Select All Elements
Rulers
Guides
Grid
Margins
Options

Customisations

ArcView allows the customisation of toolbars and menus via the View/Toolbars menu item and by right clicking on any displayed menu or toolbar. Users will not have the ability to customise toolbars but will still be able to select and deselect toolbars for use. All toolbars will be customised in the ITT to ensure that the only command items that are available are those that available via the Main Menu.

*Shortcut keys will be removed using API calls – this needs to be researched to ensure it can be done.

SET UP

The installation of IIT.exe will require the below listed actions to take place. These actions will automatically be performed by a separate application called SETUP.EXE.

- Creation of the "wue" folder in the System32 folder
 - Placement of "Survey.mxd" in the "wue" folder
 - Registration of the comIIT.dll
 - Running of a Plugin executable to allow ArcMap to use .ecw files
 - Installation of APEX True DB Grid
 - Creation of several folders and subfolders
8. C:\IIMSsurveys
 9. C:\IIMSsurveys\Current
 10. C:\IIMSsurveys\Current\orthophoto
 11. C:\IIMSsurveys\Current\textdocs
 12. C:\IIMSsurveys\Current\exports
 13. C:\IIMSsurveys\Current\propertyplans
 14. C:\IIMSsurveys\Current\databasebackup

Before a survey takes place, the personal survey geo-database will need to be placed in the C:\IIMSsurveys\Current on the surveyors' laptop. This database will then be copied to the "wue" folder of the System32 folder and will become the live personal geo-database.

QUALITY ASSURANCE

Morton Blacketer is committed to quality assurance in software engineering. We implement a number of rigorous procedures for quality assurance testing before software is delivered to the client, such as:

Testing against predefined test plans

Dedicated Quality Assurance personnel develop independent test plans in conjunction with users by reviewing user expectations, the System Specification and Testing Documentation supplied by the Programmer.

Unit testing by Programmers

Each module developed is analysed to determine decision paths, data input and data output. Programmers are responsible for ensuring all decision paths are tested, that all valid/invalid inputs are processed and that correct output is generated. These test plans form part of the inputs to Quality Assurance testing.

Standard User Interface testing

All user interfaces are tested for the following:

- Conformity to the System Specification
- Consistent throughout the application
- Suitable for the purpose
- Acceptance for end-users

On-Line Help

On-Line help will be provided for all screens.

REVISION HISTORY

Version 1.04 29 Jan 2002

- Document Revision
- Revision Date
- Modification of all sections except Property Plans
- Addition of Database Restoration and Set up sections

Version 1.03 23 Jan 2002

- Document Revision
- Revision Date
- Quality Assurance section added
- Modification of Database tables, Database design
- Modification of Overview, Property Plans, Property Selection and Maintenance

Version 1.02 22 Jan 2002

- Document Revision
- Revision Date
- Graphics number of colours reduced

Version 1.01 18 Jan 2002

- Document Revision
- Revision Date

Version 1.00 02 Jan 2001

- Document Revision
- Revision Date