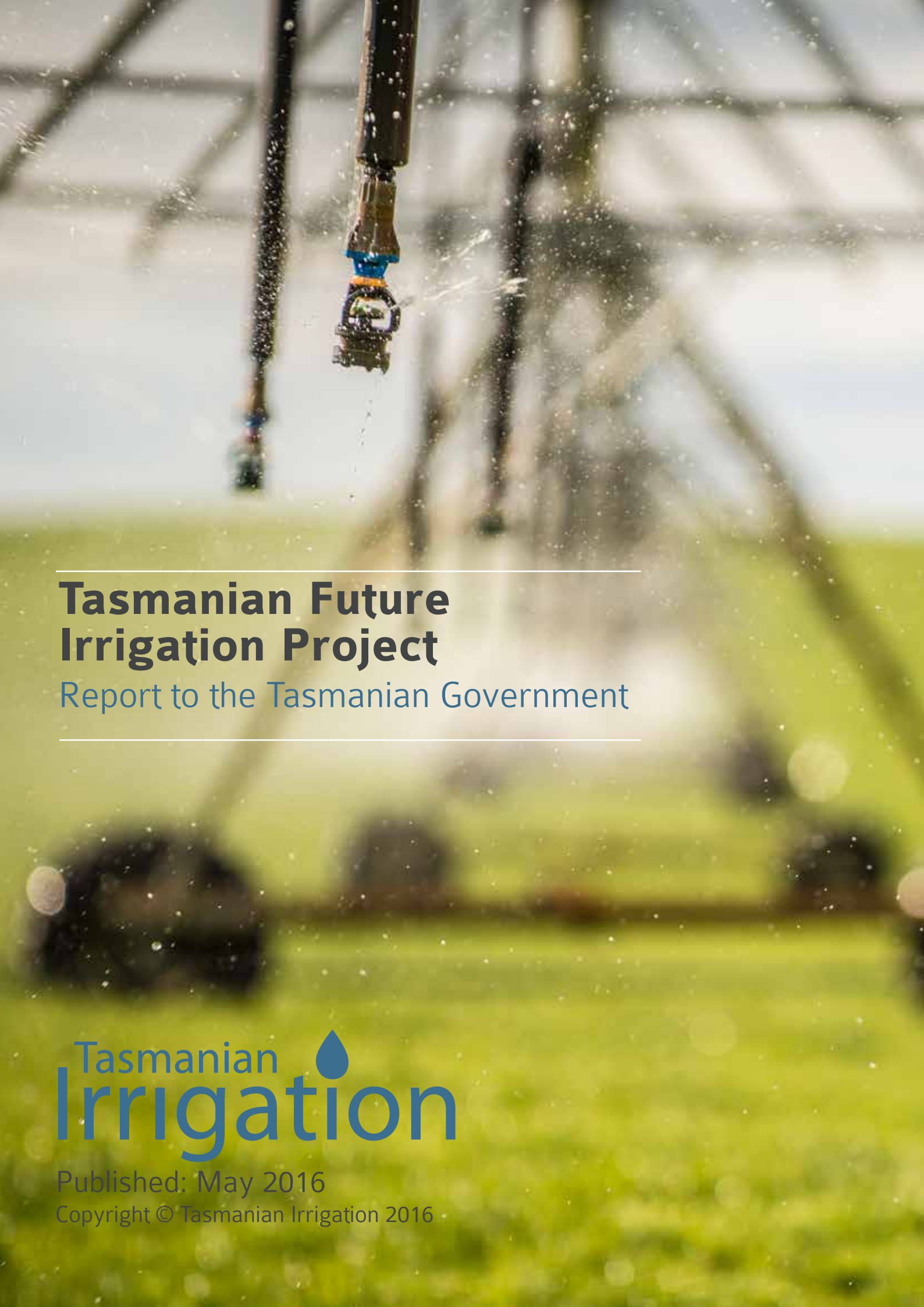

Tasmanian Future Irrigation Project

Report to the Tasmanian Government

Tasmanian Irrigation

Published: May 2016

Tasmanian Irrigation Pty Ltd ABN 95 722 799 075

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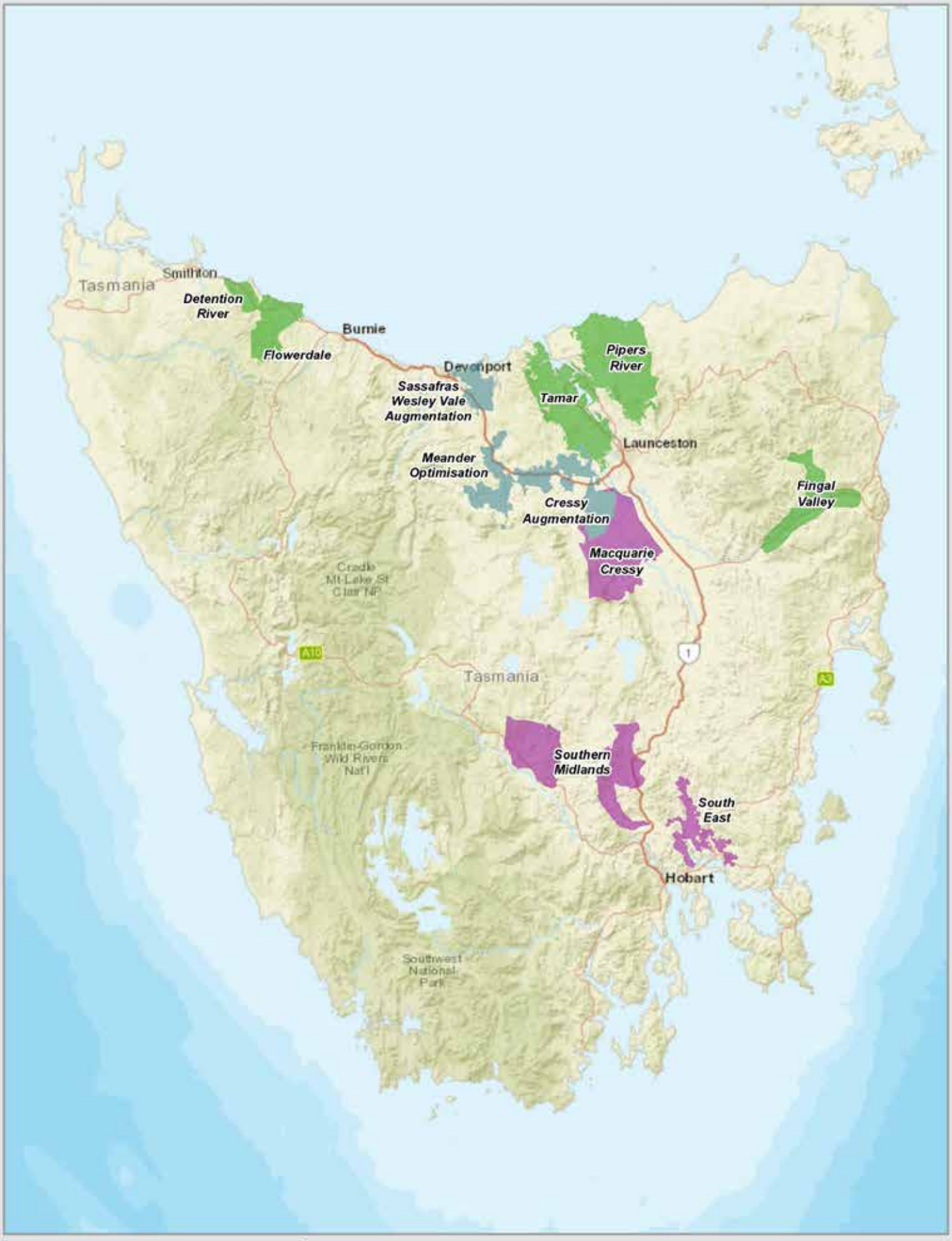

Legend

Stage 3 Priority Concept Type:

Enhancement | Interconnectivity | New Development

Priority Concepts for Further Investigation Identified via Stage 3 Analysis

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Map No: FIP-M1942-001
Version No: 001
Date: 10/05/2016
Map Created by: E.Tys
Tasmanian Irrigation

Tasmanian Irrigation

Executive Summary

The Tasmania Future Irrigation Project - builds on Tasmanian Irrigation's successful delivery of Tranche 1 (10 schemes 2010 – 2015) in its entirety and its ongoing commitment to deliver Tranche 2 (5 schemes 2016 – 2018).

Irrigation, coupled with Tasmania's unique climate and agricultural skills base, which underpin the Tasmanian economy, will allow the State to deliver on the *Tasmanian Government's Cultivating Prosperity – A vision for Agriculture.*

After extensive investigation and consultation TI has identified 11 concepts which will enhance the productive capacity of Tasmania. TI has begun to progress three of these concepts internally as they will create more efficient delivery of existing irrigation schemes. These three concepts are the South East Integration, Cressy Augmentation and Meander Modernisation.

Of the remaining 8 concepts:

1. Two will provide interconnectivity to and between existing schemes, allowing water to be moved to areas of higher productive utilisation.
2. One will enhance an existing schemes' capacity by integrating existing infrastructure; and
3. Five are new schemes where provision of water would change the land use and productive capacity of existing farming areas.

The determination of which of the eight schemes should be developed to business case level will involve further dialogue internally within TI and with the State Government in order to ensure that scarce public funding is used to ensure the highest possible benefits to the Tasmanian community.

Concept	ML	Capex (Million)	Capex $/ML	NPV $/ML	Type
Macquarie Cressy	14,000	$23.3	$1,664	$2,672	Interconnectivity
Southern Midlands	11,000	$46	$4,182	$306	Interconnectivity
Sassafras Wesley Vale	1,805	$4	$2,216	$7,286	Enhancement
Detention	3,000	$8.6	$3,200	$2,478	New development
Fingal	7,200	$19.1	$2,653	$3,510	New development
Flowerdale	3,000	$10.9	$3,633	$3,074	New development
Pipers	2,500	$10.3	$4,120	$495	New development
Tamar	4,000	$27.8	$6,950	$3,299	New development

Purpose

Private and public funding investment in the order of $310 million has seen the successful delivery of irrigation schemes under Tranche 1, with ten new irrigation schemes built across the State. Tranche 2 is now underway and will invest $156 million dollars in irrigation and deliver a further five irrigation schemes in the State. In recognition of the value of irrigation to Tasmania and to build on the investment already made, the Tasmanian Government requested that Tasmanian Irrigation Pty Ltd (TI) provide advice to the government on:

1. Potential opportunities for interconnectivity between existing irrigation schemes;
2. Potential opportunities for enhancement and modernisation of existing irrigation schemes throughout Tasmania;
3. Renewable energy opportunities; and
4. Potential opportunities for the development of new irrigation schemes.

To achieve this outcome TI was provided with funding in April 2015 under the Tasmanian Government's *Cultivating Prosperity: A 2050 Vision for Agriculture* policy to implement the business plan for the *"Tasmanian Future Irrigation Project"*.

Scope

The *"Tasmanian Future Irrigation Project"* reviewed all public schemes across the state for potential areas of interconnectivity or enhancement.

When reviewing schemes for interconnectivity particular focus was placed on identifying economic opportunities to its highest economic use. Hence the aim was to explore concepts that connected areas of good land capability with limited access to water to existing schemes in the state.

When reviewing schemes for enhancement particular focus was placed on identifying opportunities that would increase the operational capacity and efficiencies of existing schemes. The project sought to identify opportunities that would: provide additional delivery capacity; increase delivery efficiency through pump station and control improvements; reduce the reliance on channel and river delivery and associated transmission losses; and increase scheme delivery reliability.

The project also reviewed each agricultural region of the state to determine new areas for irrigation schemes where land capability suitable for irrigation was matched to potential high water yields.

Investigations were carried out into renewable energy opportunities with the focus on the potential for on farm hydro power to assist with on farm and scheme efficiencies only.

Process

TI commenced work on the Tasmanian Future Irrigation Project in April 2015. Over the following twelve months TI implemented the three stage assessment and analysis process outlined in Figure 2, to identify feasible concepts for irrigation development that merited further investigation. TI established a working group to determine how the three stage assessment process would be implemented. The membership of the working group included external engineering and agricultural expertise.

Consultation

An expression of interest process was instigated within the agricultural community that was facilitated by the Tasmanian Farmers and Graziers Association (TFGA), to identify areas where there was a groundswell of support to develop future irrigation areas. A total of 11 submissions outlining ideas for schemes were received during the expression of interest process.

TI understands that within Hydro Water Districts, any transfer or allocation of water must be agreed to by Hydro Tasmania and if water is sourced directly from storages owned and operated by Hydro Tasmania, commercial arrangements for the purchase of that water may be required. Hence TI has discussed the Tasmanian Future Irrigation Project with Hydro Tasmania. In particular the Macquarie-Cressy and Southern Midlands concepts which are likely to require sourcing water from Hydro Tasmania catchments and dams. Both parties will continue to discuss the details and potential issues as these opportunities are progressed further.

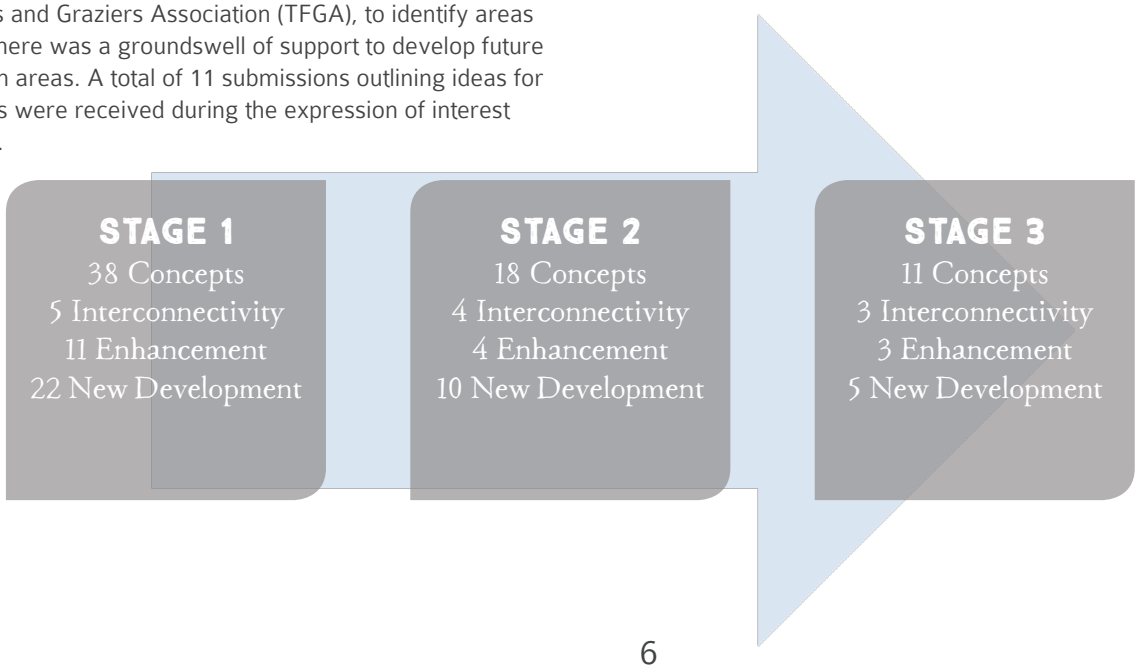


Figure 1: Tranche 1 and Tranche 2 irrigation schemes

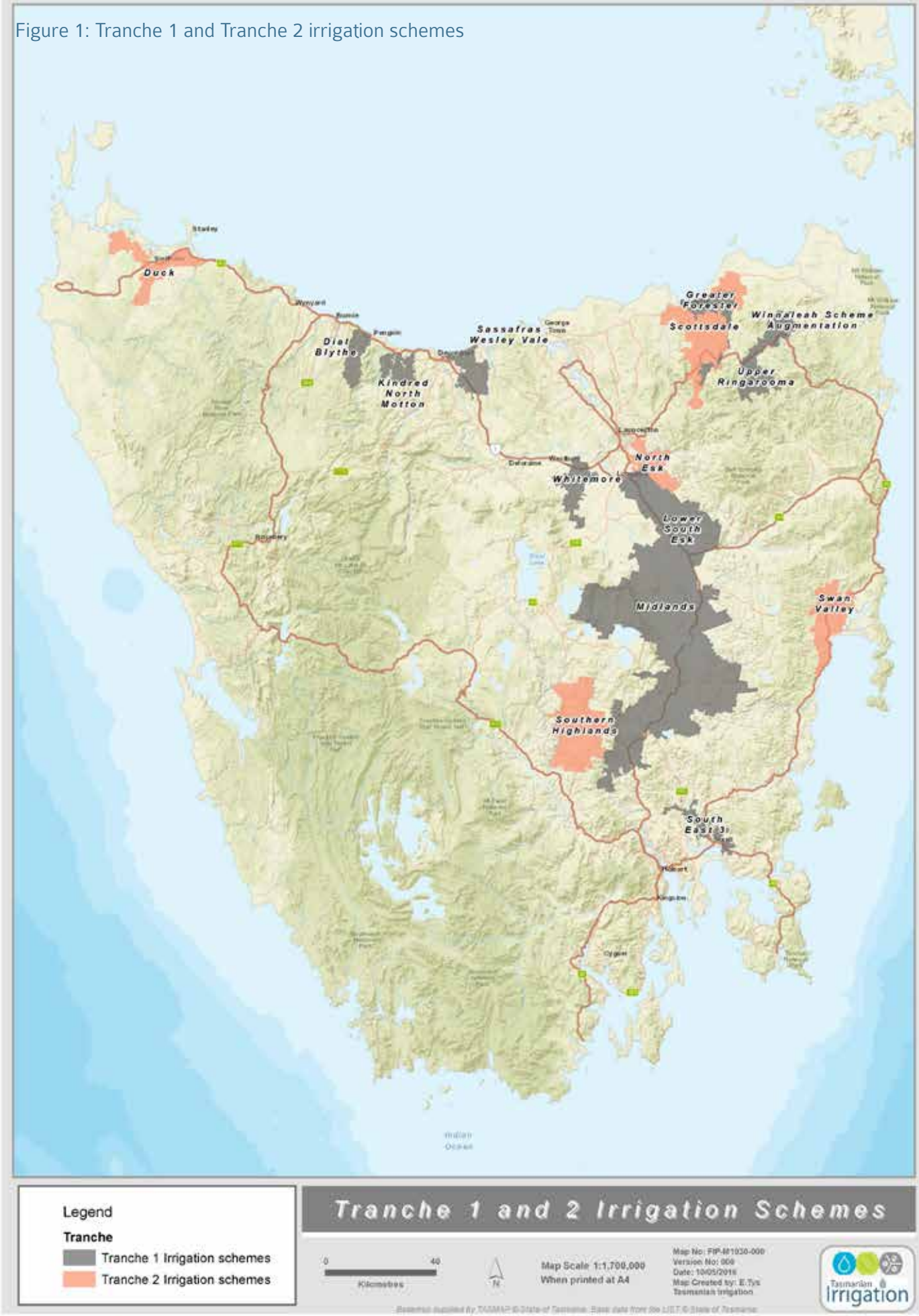
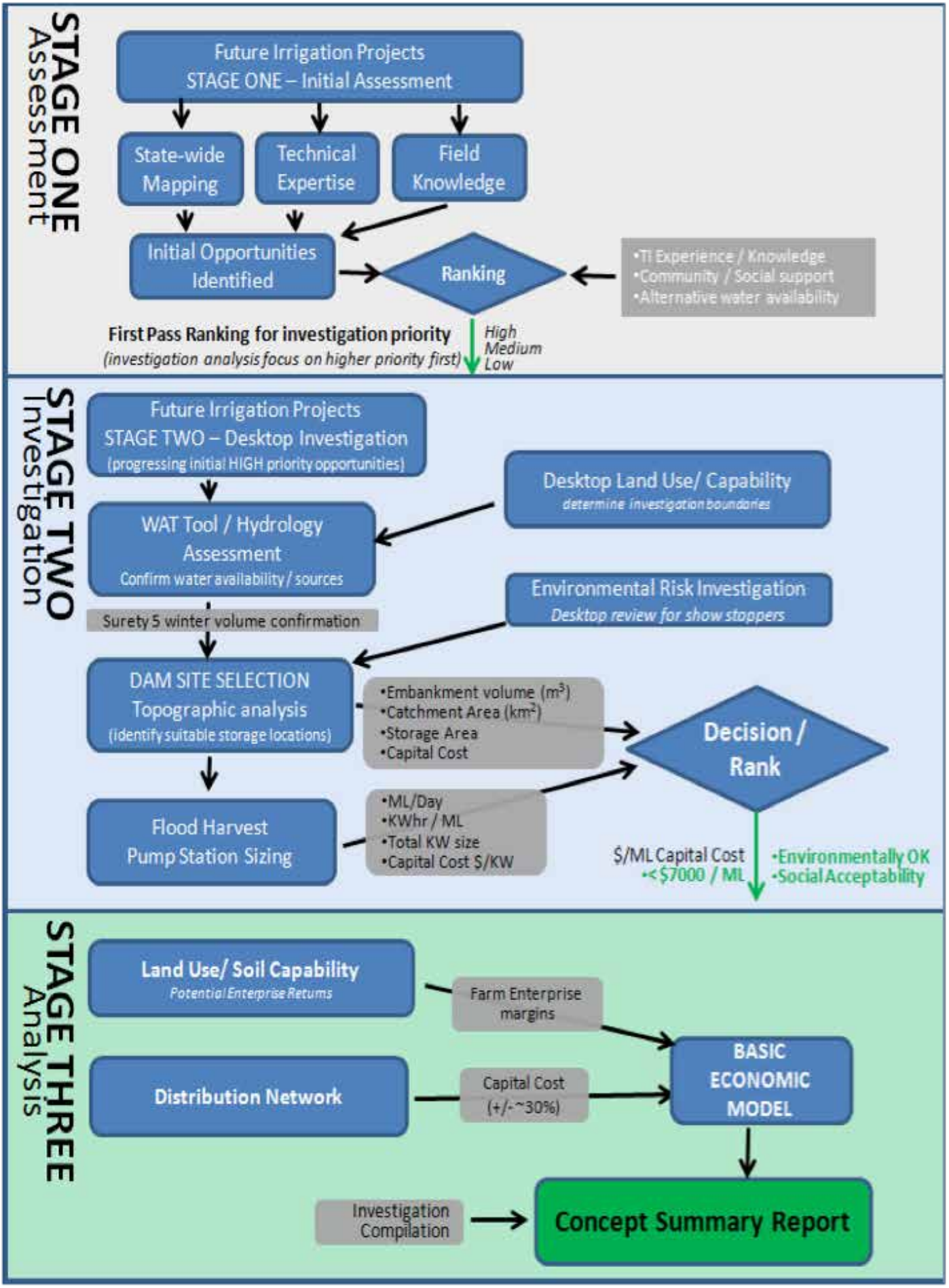


Figure 2: Framework for assessing potential irrigation opportunities



Stage 1 Assessment

The process for Stage 1 Assessment included a review of the strategic water development opportunities outlined in the Tasmanian Government's *Water Development Plan for Tasmania 2002*. A literature review of the schemes investigated by the Water Development Branch, a section of the then Department of Primary Industries and Water, Water Resources Division, was completed. The review found that the majority of viable options identified by the Water Development Branch had been incorporated into the Tranche One and Tranche Two projects. However the concepts of Chimney Hill, St Pauls and Parramatta Creek were revisited during this project.

The review of concepts for Stage 1 assessed statewide land capability maps and compared existing water allocations and available yield across catchments and agricultural regions. In areas where adjoining land capability was marginal to low, or where easy access and suitable on-farm storage options for a water source with high yields were present, concepts did not progress to Stage 2 investigations. The area reviewed at Stage 1 is outlined in Figure 3. In total an area of 1,100,000 hectares was assessed for long term irrigation suitability as part of Stage 1.

The Stage 1 assessment process identified a total of thirty nine concepts to progress to Stage 2 investigations. The concepts identified at Stage 1 are listed in Appendix 1.

Stage 2 Investigation

The Stage 2 Investigation involved a more detailed assessment of the thirty nine concepts identified at Stage 1. The methods applied by TI to complete the Stage 2 Investigation can be found in Appendix 2 .
The summary of each of the 18 concepts, including constraints is provided in Appendix 4. The total area of land assessed during the stage 2 process was 670,000 hectares (Figure 4).
At the end of the Stage 2 Investigation process a total of 18 concepts were identified. Four concepts were classed as interconnectivity, four were classed as enhancement and ten were classed as new developments. The total area of land that was identified as being suitable for irrigation across the 18 concepts was 231,000 hectares (Figure 5). The volume of water identified for further irrigation purposes totalled 68,000 ML.

Stage 3 Analysis

The Stage 3 Analysis conducted a baseline feasibility comparison on the 18 concepts identified during the Stage 2 process. The comparison undertaken included a cost ratio of capital expenditure and operational costs to the expected scheme economic returns for the region. The methods applied by TI to complete the Stage 3 Analysis are outlined in Appendix 3.

At the end of the Stage 3 Analysis a total of 11 concepts were prioritised as being recommended for further investigations as detailed in Table 2. Three concepts were classed as interconnectivity, three were classed as enhancement and five were classed as new developments.

TI has begun to progress three of these concepts internally as they will create more efficient delivery of existing irrigation schemes. These three concepts are the South East Integration, Cressy Augmentation and Meander Modernisation.

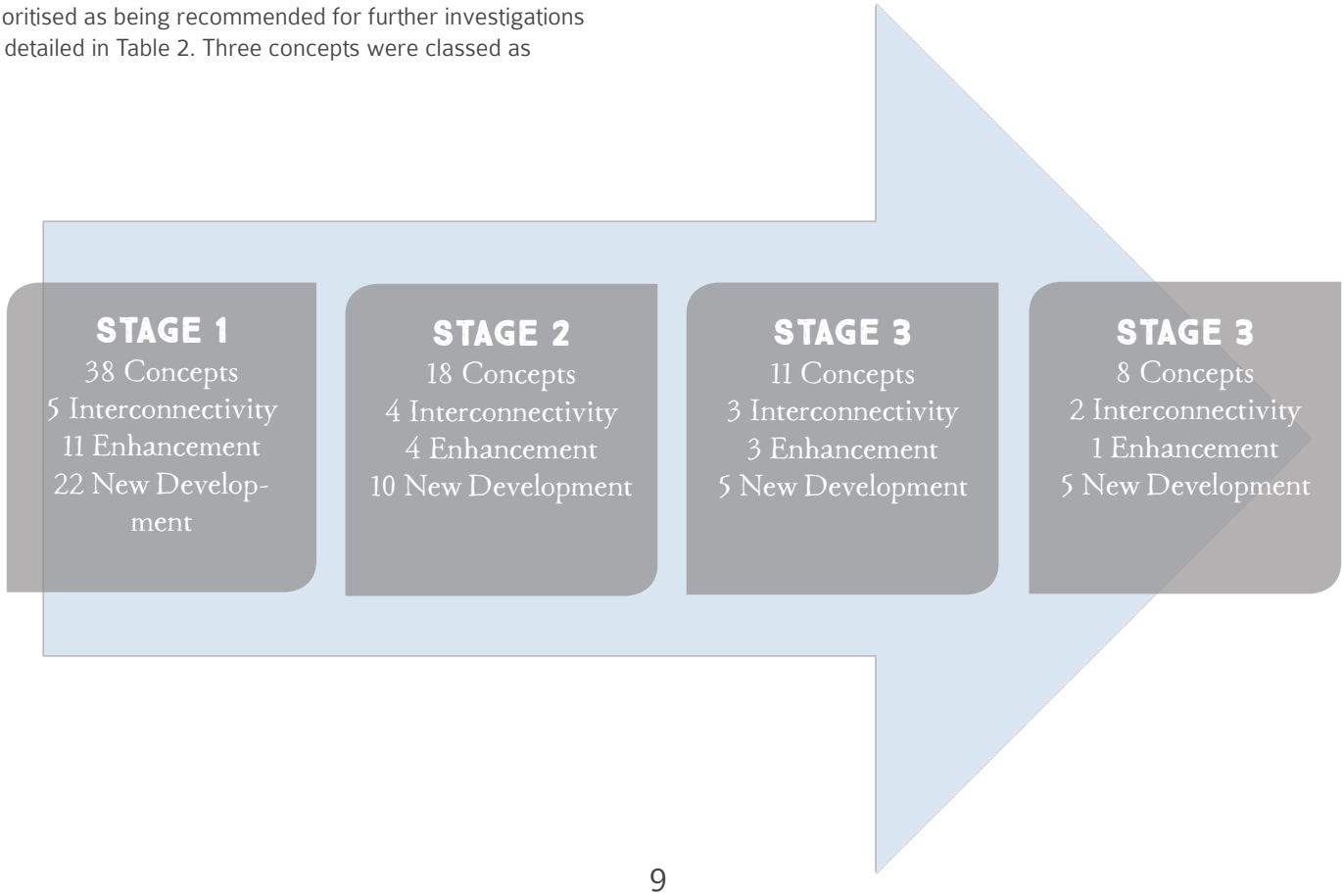


Figure 3: Area assessed under the Stage 1 Assessment process

Legend

- Stage 1 assessment area
- Concepts investigated in stage 1 process

Area Assessed Under Stage 1 Assessment Process

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Kilometres

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Map Scale 1:1,700,000
When printed at A4

Map No: FIP-M1939-000
Version No: 000
Date: 6/05/2016
Map Created by: E.Tys
Tasmanian Irrigation

Basemap supplied by TASMAP © State of Tasmania. Base data from the LIST © State of Tasmania.

DISCLAIMER: This map is for informational purposes only. It should not be relied upon to establish with certainty the location of any of the features represented on it, either absolutely or in relation to other features.This map is not suitable for site specific decision making.

Figure 4: Area assessed under the Stage 2 Investigation process

Figure 5: Area identified as being suitable for long term irrigation at Stage 2

Figure 6: Priority concepts for further investigation identified via Stage 3 Analysis

Key findings

The Tasmania Future Irrigation Project determined that a total of eleven priority concepts warranted being recommended for further investigation at this stage. Concept summary reports have been completed for eight of the concepts. A concept summary report has not been completed for the South East Integration concept as TI is progressing the solution internally to connect SEIS 2 to SEIS 3 as it is beneficial to the operational efficiencies of the South East region and the construction costs for connecting SEIS1 to SEIS 3 are at a level that private investment could cover the cost of construction.

A concept summary report has not been completed for the Cressy Augmentation or Meander Optimisation as TI is progressing the solutions within these concepts internally with current resources.

A summary of the capital expenditure and the Net Present value for each of the concepts investigated is outlined in Table 1 below.

Table 1: Summary of capital expenditure and net present value for Tasmanian Future Irrigation Project priority concepts

Concept	ML	Capex (Million)	Capex $/ML	NPV $/ML	Type
Macquarie Cressy	14,000	$23.3	$1,664	$2,672	Interconnectivity
Southern Midlands	11,000	$46	$4,182	$306	Interconnectivity
Sassafras Wesley Vale	1,805	$4	$2,216	$7,286	Enhancement
Detention	3,000	$8.6	$3,200	$2,478	New development
Fingal	7,200	$19.1	$2,653	$3,510	New development
Flowerdale	3,000	$10.9	$3,633	$3,074	New development
Pipers	2,500	$10.3	$4,120	$495	New development
Tamar	4,000	$27.8	$6,950	$3,299	New development

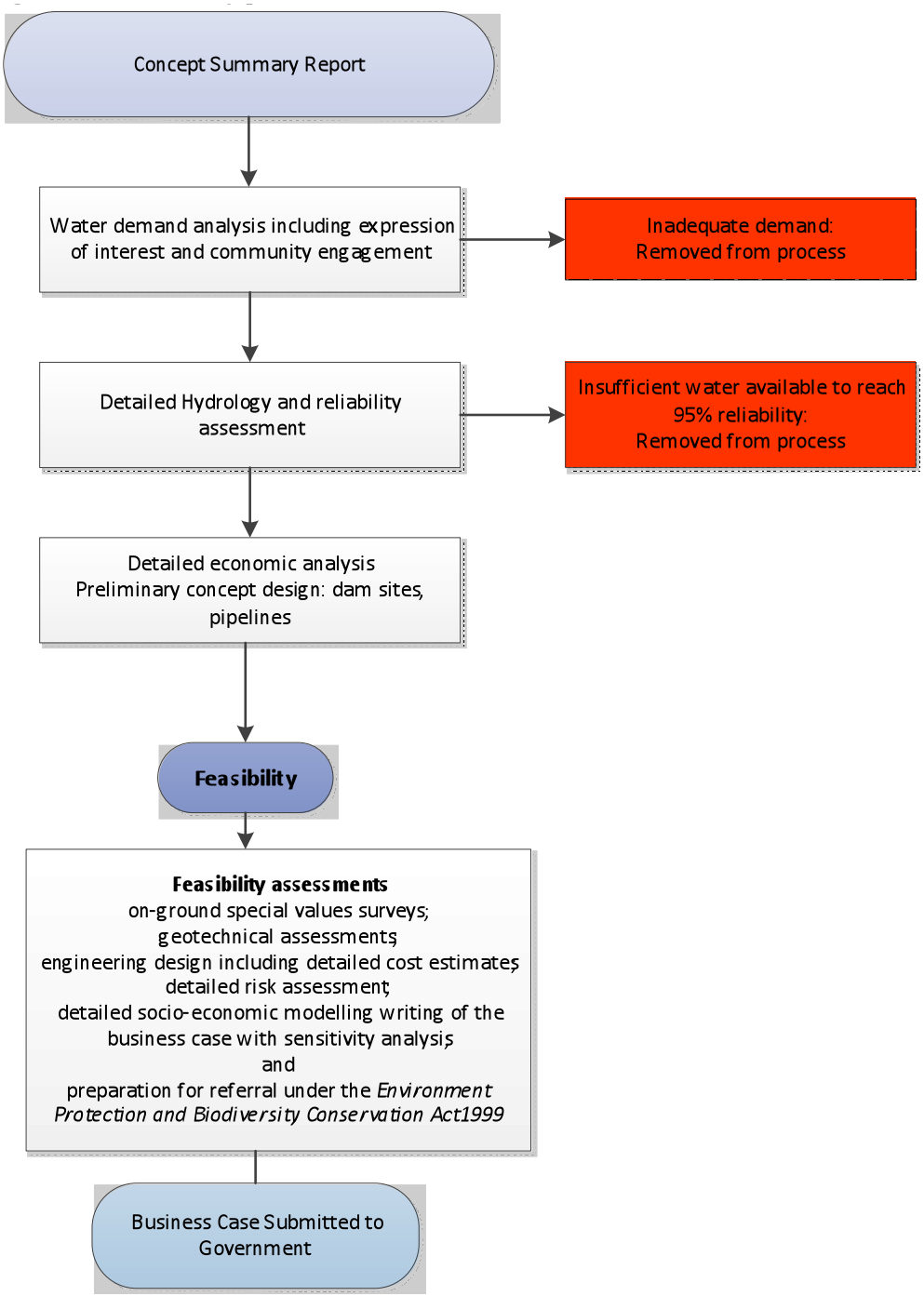
Further Investigations

TI proposes that the eight concepts presented in the key findings section warrant further investigation. For the eight concept summary reports to be considered as definitive proposals sufficient to set capital investment priorities, the TI business case process outlined in Figure 7 will need to be completed. Once this process is completed considerations for capital investment can be made against a rigorous business case for each completed concept.

The first step to be taken under the process will be to conduct extensive community engagement to determine if there is demand and support for the scheme within the community of interest. If this first step is achieved, rigorous environmental and economic analysis will be conducted based on the level of real demand volumes for the scheme. Hence under the TI business case process only schemes that have social, economic and environmental standing will be progressed.

To commence this process TI has submitted a funding application to the National Water Infrastructure Development Fund. The funding application proposes to complete the first three tasks (community engagement, hydrology assessment, detailed economic analysis) for six of the priority concepts outlined within this report. The six priority concepts put forward were, Macquarie Cressy, Southern Midlands, Sassafras Wesley Vale, Flowerdale, Pipers and Tamar. TI proposes to take the two concepts that are ranked as the top two after this process through to completing a full business case. Having an accepted business case in place will mean that these two concepts will be considered, investment ready irrigation schemes.

Figure 7: Business case flow chart



Concept Summary Reports

1. Macquarie Cressy
2. Southern Midlands
3. Sassafras Wesley Vale
4. Detention
5. Fingal
6. Flowerdale
7. Pipers
8. Tamar

Concept Summary Report - Macquarie Cressy

Volume (ML)	Irrigable Area (ha)	Storage capex $M	Distribution capex $M
14,000	56,461	$2.5	$20.8

Background

The Macquarie – Cressy concept presents an opportunity of securing an additional 14,000 ML of high reliability water from Poatina for use within agricultural areas south east of Poatina and within the areas of Lake River and Isis River. The concept proposes to construct a 1,000 ML holding dam that would store a ten day supply that would buffer flows in the system and safeguard reliability during short-term outages of the Poatina power station. A total of 56,461 hectares have been identified as suitable for long term irrigation with 8,015 hectares in the concept area classed as prime agricultural land.

Example Enterprises

- Livestock
- Broadacre cropping including poppies, cereals
- Fruit and vegetables
- Wool
- Fodder
- Dairy
- Seed (perennials, grass and vegetable)

Proposed Infrastructure

A number of potential holding dam sites have been identified which may be suitable for the scheme, however the final site will be determined once demand for the scheme is determined.

The proposed concept will involve the construction of:

1. A 1,000 ML holding dam;
2. A gravity fed 25 km delivery pipeline network; and
3. A riparian release on the Isis River.

Hydrological Analysis

The potential future demand for irrigation across the concept area is 141,153 ML. This volume has been derived by assuming an application of 2.5ML/ha across the identified irrigable land. There is currently 48,900 ML allocated via water licences with DPIPWE across the area.

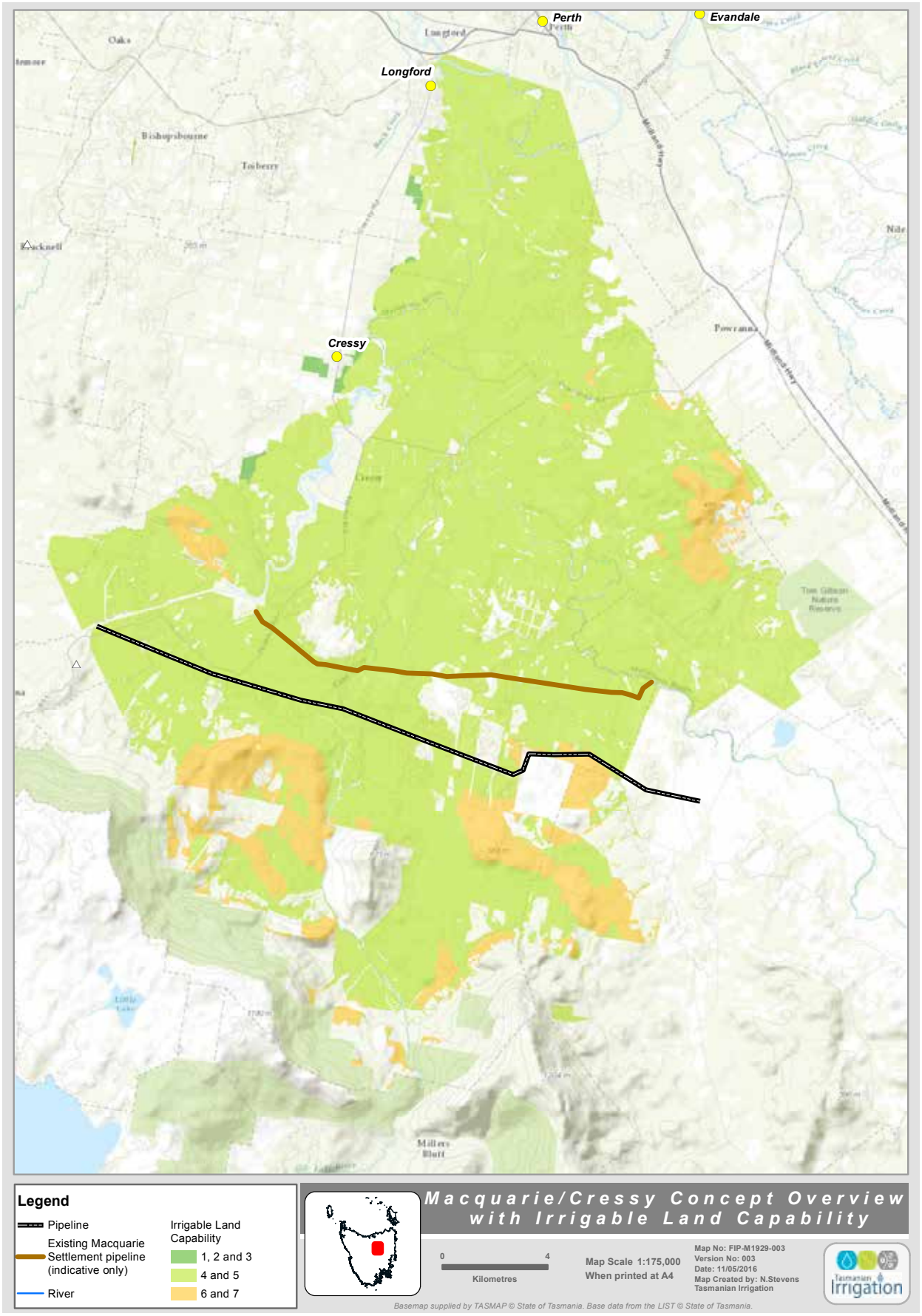
Poatina is considered a highly reliable water source that is fed from the Great Lake Hydro storage. Modelling indicates that suitable levels of water are available for the concept. As Poatina is managed by Hydro Tasmania within a Hydro Water District, a water supply agreement with Hydro Tasmanian will be required to approve and transfer the water rights to TI.

Environmental Overview

Detailed flora and fauna assessments will be required for the dam footprint and transfer pipeline to ensure that there are no significant impacts on threatened flora and fauna. However it is anticipated that the standard controls implemented by TI during construction and operation will mitigate any impacts on environmental values.

As the concept proposes to deliver water into the Isis River and Lake River, aquatic impact assessments will need to be completed to ensure that the delivery water does not have any impacts on aquatic values within these rivers. Transmission losses will also need to be determined for the sections of the Isis River and Lake River that water will be delivered through.

Total capex $M	Opex ($/ML)	Est. Net Margin	NPV
$23.3	$82/ML	$400/ML	$2,672/ML



Concept Summary Report - Southern Midlands

Volume (ML)	Irrigable Area (ha)	Storage capex $M	Distribution capex $M
11,000	33,407	$0	$46.0

Background

The Southern Midlands concept presents an opportunity to deliver a long term vision to provide a secure water supply into the Southern Midlands. The concept proposes to construct a 57km pipeline to deliver 11,000 ML of summer irrigation water to areas within the Southern Highlands and Midlands Irrigation Districts. High reliability water for the scheme would be sourced from Lake Echo via an agreement with Hydro Tasmania then stored within the existing Hydro Tasmania owned Dee Lagoon. There are extensive areas of land within the concept area that could be developed sustainably under irrigation as 33,407 hectares have been assessed as being suitable for irrigation.

Example Enterprises

- Livestock
- Broadacre cropping including poppies, cereals
- Fruit and vegetables
- Wool
- Fodder
- Wine grapes

Proposed Infrastructure

The concept would augment the existing Southern Highlands Irrigation Scheme and the Midlands Water Scheme by interconnecting with existing infrastructure. Within the Midlands Water Scheme area the concept proposes to supply water to the upper section of the Jordan River and deliver water via the Jordan River. Within the Southern Highlands Irrigation District the concept proposes to supply water to the upper sections of the River Dee, River Ouse and River Clyde and deliver water via these waterways.

The concept will involve the construction of:

1. A transfer pipeline from Dee Lagoon; and
2. A 57 kilometer delivery pipeline that would supply areas in the Ouse Valley, Clyde Valley and the Jordan River Valley

Hydrological Analysis

The potential future demand for irrigation across the concept area is 83,518 ML. This volume has been derived by assuming an application of 2.5ML/ha across the identified irrigable land.

There is currently 51,923 ML of water allocated via water licences with DPIPWE across the area. Hence the potential unmet demand for additional irrigation is considered to be 31,595 ML. Further the target areas within the Southern Highlands and Jordan River have bought 100% of the water offered by previous TI schemes.

Dee Lagoon is a large existing Hydro Tasmania storage fed by Lake Echo that captures flows from the River Ouse above the Monpeelyata Canal. It is considered a highly reliable water source. Modelling indicates that suitable levels of water are available for the concept. As Dee Lagoon is managed by Hydro Tasmania within a Hydro Water District, a water supply agreement with Hydro Tasmanian will be required to approve and transfer the water rights to TI.

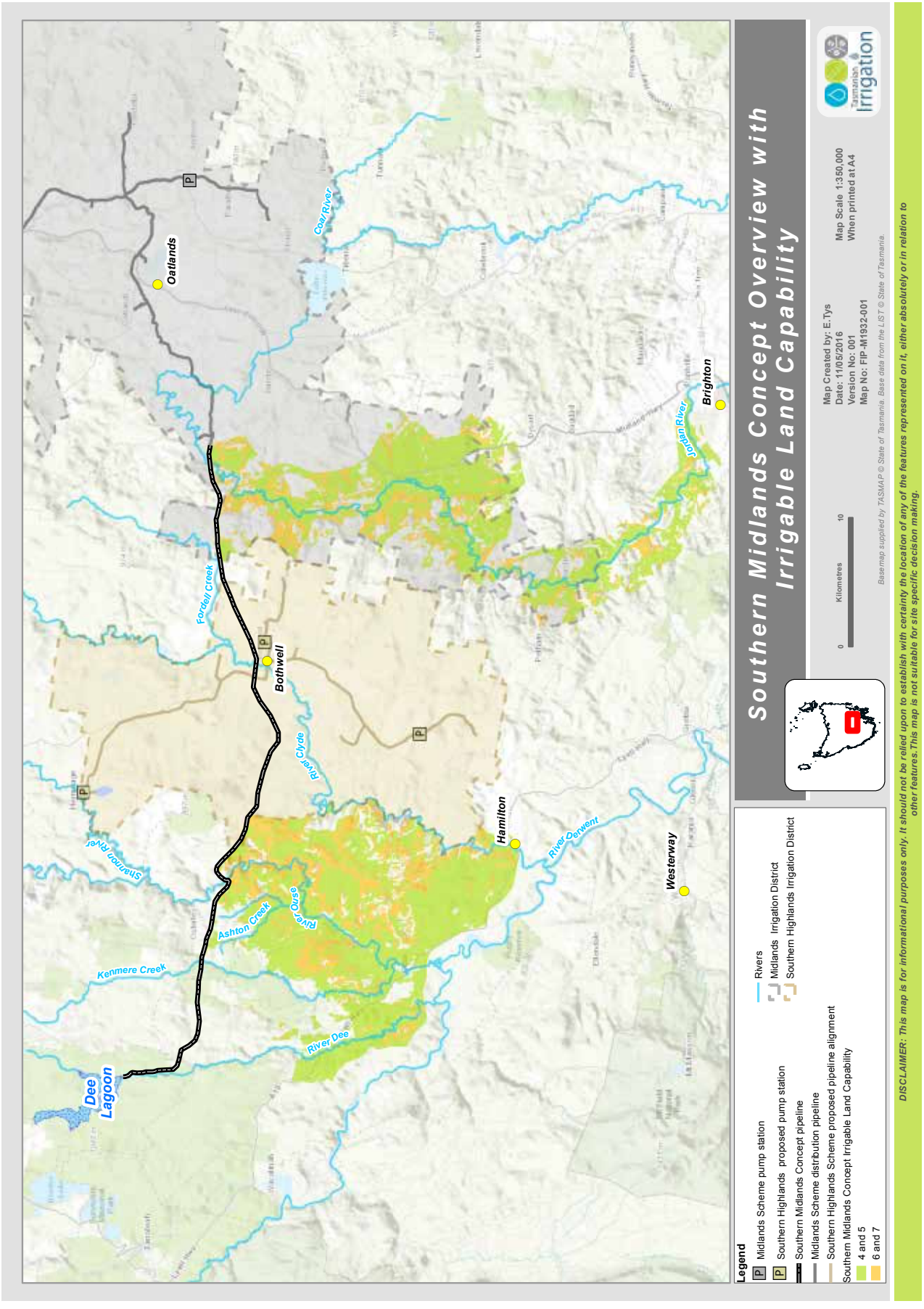
Environmental Overview

A desktop analysis of Echo Lagoon indicates that there are no aquatic values that will be impacted by the extraction of water from the storage for the concept.

Detailed flora assessments would need to be completed for pipeline infrastructure to ensure that there were no significant impacts on Lowland Native Grasslands or threatened species. However it is anticipated that the standard controls implemented by TI during construction and operation will mitigate any impacts on environmental values.

The concept proposes to transfer water into the Jordan, Dee, Ouse and Clyde Rivers. Detailed transmission loss studies will be required to determine if this is a viable delivery option for the concept.

Total capex $M	Opex ($/ML)	Est. Net Margin	NPV
$46.0	$143/ML	$459/ML	$306/ML



Concept Summary Report - Sassafras Wesley Vale

Volume (ML)	Irrigable Area (ha)	Storage capex $M	Distribution capex $M
1,805	9,000	$2.0	$2.0

Background

The Sassafras Wesley Vale (SWIS) scheme was built by TI in 2012 and is now fully subscribed. The SWIS Augmentation concept presents an opportunity to increase the operational capacity and efficiency within the Aldersons, Pardoe, Northdown and Sassafras zones to deliver an additional 1,805 ML. The concept proposes to install four new boost pump stations, upgrade the three existing pump stations and potentially build a 1,000 ML storage dam that would be filled with winter flows from the Mersey River.

Example Enterprises

- Livestock
- Broadacre cropping including poppies, cereals, pyrethrum
- Fruit and vegetables
- Fodder
- Dairy

Proposed Infrastructure

Field tests for flow and pressure were undertaken during the 2015-16 irrigation season to measure the schemes delivery capacity and efficiency. The results of testing indicate that delivery capacity could be increased by up to 33% within the Aldersons, Northdown, Pardoe and Sassafras zones by upgrading the three existing pump stations. This increased capacity would enable an additional 1,805 ML of water to be delivered within the existing pipeline infrastructure once four new boost pump stations were installed. It should be noted that the existing pipeline infrastructure needs to be tested thoroughly to ensure that augmentation is not required.

The concept also proposes to construct a strategically placed 1,000 ML dam that would be pump filled from the Great Bend pump station in winter. The dam would be connected to the existing pipeline network and would reduce TI's reliance on summer flows in the Mersey River.

The proposed concept will involve the construction of:

1. An off stream 1,000 ML dam, to be filled via the existing Great Bend pump station in winter:
2. Installation of four new boost pumps for the Aldersons, Pardoe, Northdown and Sassafras zones; and
3. Upgrade of pump control systems on existing three pump stations.

Hydrological Analysis

TI currently has a 12,410 ML surety 5 licence in place for the Mersey River as well as a water supply agreement with Hydro Tasmania for water released from the Parangana Dam when cease to take thresholds are triggered for the Mersey River.

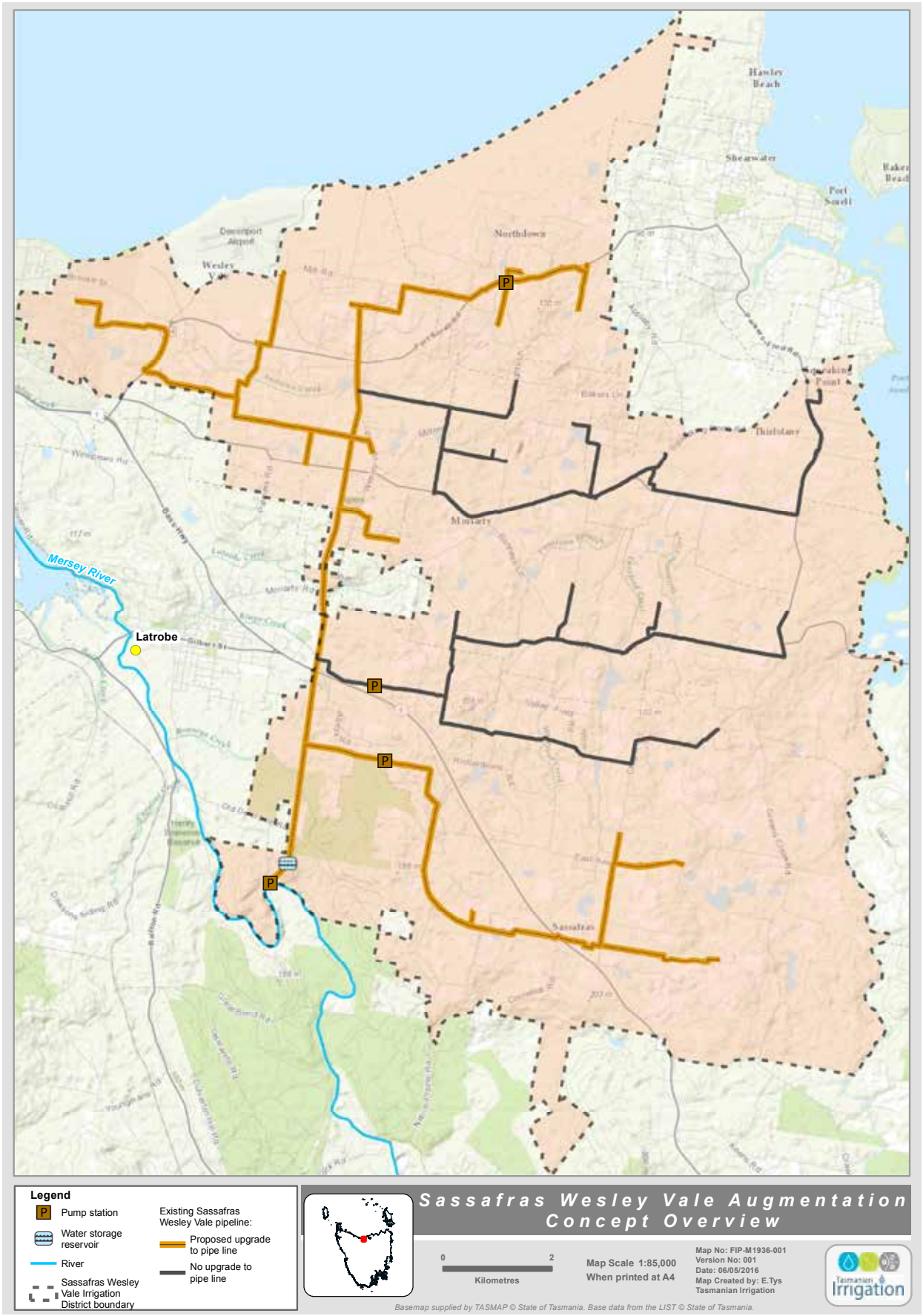
There is currently 12,000 ML of winter water at a surety 5 level available for allocation under the Mersey Water Management Plan. The concept would require an additional allocation of 12 ML/day. TI does not perceive any issues in obtaining this additional water.

Environmental Overview

Water applied in this concept will be via existing infrastructure and onto areas already covered by Farm Water Access Plans. The land capability across the area that water will be applied is prime agricultural land. Hence the volume of water being applied per hectare is well within application rate limits. It is not expected that there will be any environmental impacts as a result of the additional water being applied.

Central north burrowing crayfish and green and gold frogs are known to exist across the SWIS concept area. Hence any infrastructure placement would need to be assessed for impacts on these species.

Total capex $M	Opex ($/ML)	Est. Net Margin	NPV
$4.0	$132/ML	$839/ML	$7,286/ML



Concept Summary Report - Detention

Volume (ML)	Irrigable Area (ha)	Storage capex $M	Distribution capex $M
3,000	3.080	$6.9	$2.7

Background

The Detention River concept presents an opportunity to provide an additional 3,000 ML of water into an established dairy area in the north west of the state. The concept proposes to construct a 6,000 ML dam on the Alarm River and deliver water via natural watercourses during a summer irrigation season. Land capability potential across the identified scheme area is high with nearly half the identified irrigable land (1,533 ha) being classed as prime agricultural land.

Example Enterprises

- Livestock
- Fruit and vegetables
- Broadacre cropping including poppies, pyrethrum
- Fodder
- Dairy

Proposed Infrastructure

Various dam sites in the area were assessed including Hook Creek, where a 10,000 ML dam was previously recommended in 2002. However analysis of the Water Assessment Tool indicates that inflows to the dam at this site would only actually capture 1,431 ML at a Surety 5 level. An onstream dam located on the Detention River was identified with a storage ratio of 240:1. However, it was determined that the environmental values at this site were too high to progress the concept any further.
The proposed concept will involve the construction of:

1. An on stream 6,000 ML dam on Alarm Creek;
2. A pump station with a 400m rising main on the Detention River;
3. A simple boosted distribution pipeline of 7 kilometers from the Alarm Creek dam site to three branches of Wilsons Creek; and
4. A riparian release on the Detention River.

Hydrological Analysis

The potential future demand for irrigation across the concept area is 7,700 ML. This volume has been derived by assuming an application of 2.5ML/ha across the identified irrigable land. There is currently 4,009 ML allocated via water licences with DPIPWE across the area. Hence the potential unmet demand for additional irrigation is considered to be 3,691 ML.

The Water Assessment Tool indicates that natural inflows to the dam total 1,100 ML at a Surety 5 level. The Water Assessment Tool indicates that 3,900 ML of winter water is available at a Surety 5 Level for the Detention River. The concept would potentially need a licence that allocated all remaining available water in the areas to the dam site. Daily analysis would need to be completed to ensure that the entire volume of water allocated could actually be captured via a daily pumping regime. Hence without further investigations being completed the hydrology for the concept is considered marginal at this stage.

Environmental Overview

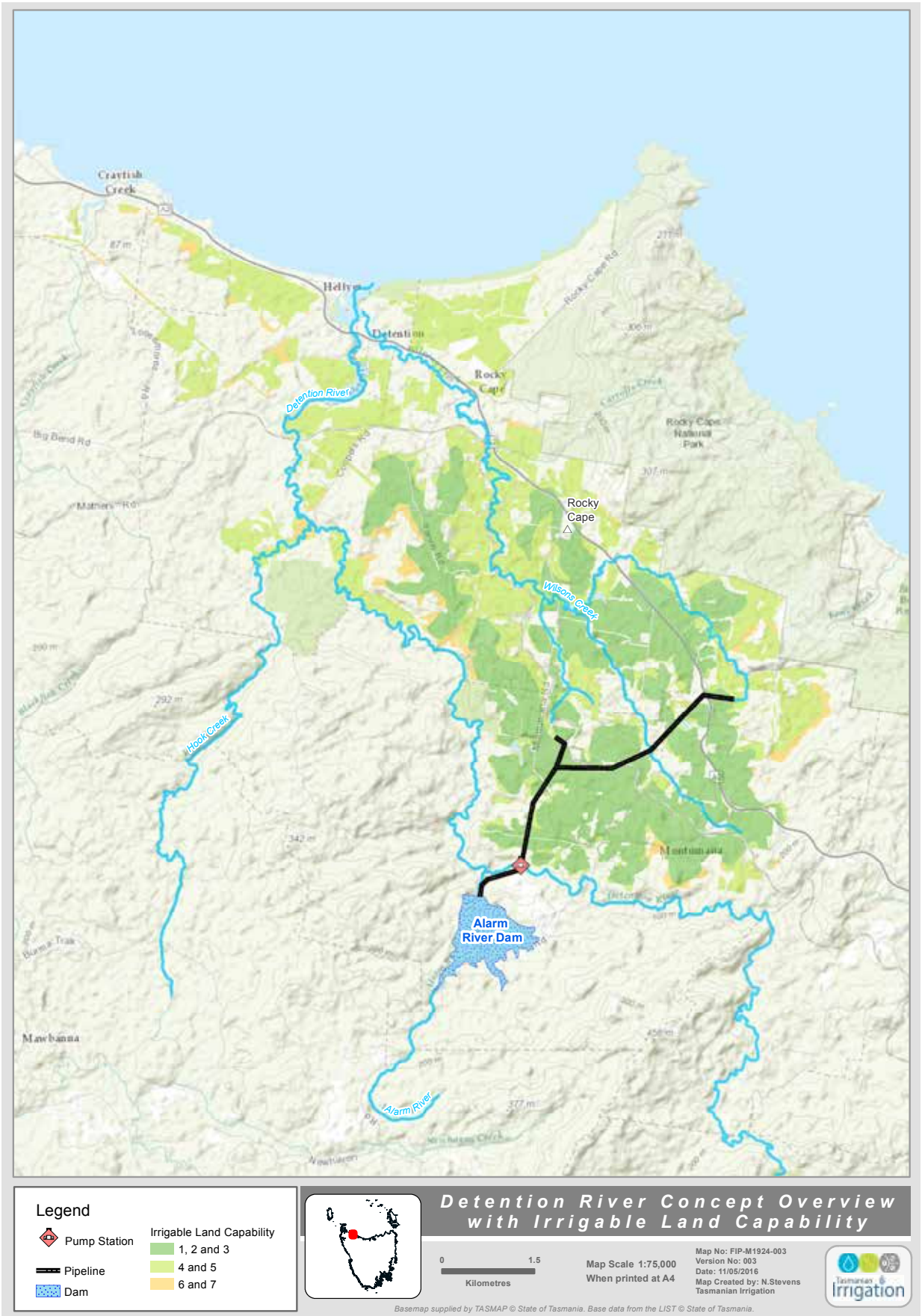
The proposed dam is situated on a tributary of the Detention River. Desk top analysis indicates that the site is potentially an important location for the giant freshwater crayfish. There are also numerous records of other threatened species such as the Tasmanian devil and grey goshawk. The dam site is a mosaic of grassland and vegetation with the threatened vegetation community Riparian Scrub present within the dam footprint. Hence the site may provide high quality foraging and nest / denning habitat for a number of threatened species.

Detailed flora and fauna assessments will need to be completed to ensure that there are no significant impacts on threatened species.

As the concept proposes to extract available winter flows it is unlikely that there will be any impacts on the aquatic values within the Detention River during the operation of the scheme. However, cease to take limits will need to be set to ensure that there are no impacts on species such as the giant freshwater crayfish.

The concept proposes to deliver water into three branches of Wilsons Creek. However, these creeks are in fact chains of linked dams which may be difficult to deliver water down. Transmission loss and flow studies would need to be completed to determine if the proposed delivery option for the concept is feasible. If the delivery of water into the creeks is not feasible then additional pipelines and river pumps may be required for water to reach the coastal plains.

Total capex $M	Opex ($/ML)	Est. Net Margin	NPV
$9.6	$136/ML	$550/ML	$2,478/ML



Concept Summary Report - Fingal

Volume (ML)	Irrigable Area (ha)	Storage capex $M	Distribution capex $M
7,200	14,507	$19.1	$0.0

Background

The Fingal Valley concept provides an opportunity to deliver a 7,200 ML supply of high reliability water to an irrigation district upstream of the existing Lower South Esk Irrigation District. The concept involves the construction of a dam on Pig Creek that would be filled via a winter take from the South Esk River. Irrigation water would be supplied via riparian takes along the South Esk River. There are extensive areas of land within the concept area that could be developed sustainably under irrigation as 14,507 hectares have been assessed as being suitable for irrigation.

Example Enterprises

- Livestock
- Broadacre cropping including poppies, cereals
- Fruit and vegetables
- Wool
- Fodder
- Dairy
- Essential oils
- Seed (perennials, grass and vegetable)

Proposed Infrastructure

The concept will involve the construction of:

1. An off-stream 10,000 ML dam on Pig Creek;
2. A pump station and rising main on the South Esk River;
3. A three kilometer transfer pipeline from the South Esk River; and
4. A delivery pipeline into irrigation areas upstream of the Pig Creek Dam.

Hydrological Analysis

The potential future demand for irrigation across the concept area is 36,268 ML. This volume has been derived by assuming an application of 2.5ML/ha across the identified irrigable land. There is currently 9,799 ML allocated via water licences with DPIPWE across the area. Hence the potential unmet demand for additional irrigation is considered to be 24,469 ML.

The Water Assessment Tool indicates that natural inflows to the dam total 327 ML at a Surety 5 level. The Water Assessment Tool indicates that 44,000 ML of winter water at a Surety 5 Level is available in the South Esk River. The proposed pump station site sits within the Upper South Esk River Management Zone identified within the South Esk River Catchment Water Management Plan, (June 2013) hence a 20% transmission loss to water delivered via the South Esk River will need to be applied.

Detailed modelling, including daily takes, is required to determine the optimum combination of dam and pump station capacities to achieve a reliability of 95%.

Environmental Overview

A desktop analysis of the Pig Creek dam site indicates that agricultural land and plantations cover 86% of the construction footprint. There are no threatened vegetation communities at the site with the 13 hectares present consisting of a mix of wet and dry forest and woodland. There are no records of threatened flora or fauna species at the site.

Detailed flora and fauna assessments will be required for the dam footprint and transfer pipeline to ensure that there are no significant impacts on threatened flora and fauna. However, it is anticipated that the standard controls implemented by TI during construction and operation will mitigate any impacts on environmental values.

As the concept proposes to extract available winter flows it is unlikely that there will be any impacts on the aquatic values within the South Esk River during the operation of the scheme. Cease to take limits placed on the winter water licence for both dam inflows and the diversion point on the South Esk River will further ensure that there are no impacts on aquatic values.

Total capex $M	Opex ($/ML)	Est. Net Margin	NPV
$19.1	$116/ML	$568/ML	$3,510/ML

Concept Summary Report - Flowerdale

Volume (ML)	Irrigable Area (ha)	Storage capex $M	Distribution capex $M
3,000	7,135	$6.9	$4.0

Background

The Flowerdale concept presents an opportunity to provide an additional 3,000 ML of high reliability water into an existing highly productive irrigation area. The concept proposes to construct a 6,000 ML dam on the Hebe River or Borradale Creek and deliver water via a mix of pipelines and natural watercourses during a summer irrigation season.

Land capability potential across the identified scheme area is high with nearly half the identified irrigable land (3,359 ha) being classed as prime agricultural land. However, current growth across the area is limited by the availability of suitably sized on farm dam sites.

The concept has strong community support with expressions of interest for 3,631 ML already received.

Example Enterprises

- Dairy
- Livestock
- Broadacre cropping including poppies, pyrethrum
- Fruit and vegetables
- Fodder

Proposed Infrastructure

Two dam sites Hebe River and Borradale Creek, were short-listed after Stage 2 and Stage 3 investigations were completed. The Borradale Creek site has a higher storage ratio (50:1), lower capital costs and has less immediate impacts on aquatic values. The Hebe River site has significantly higher natural inflows than the Borradale Creek site. It is therefore likely the Hebe dam could be built at lower capacity than Borradale to provide a reliable supply without the need to pump-fill from the Flowerdale River.

Two pump stations and associated pipelines have been designed to deliver water to viable properties away from the riparian access zone, and to transfer water from the Flowerdale to the Inglis River. In general, a large portion of the water (1,737 ML) can be delivered via existing watercourses, with the majority via the Flowerdale River. This reduces the extent and cost of the distribution network compared to many other TI schemes.

The proposed concept will involve the construction of:

1. An on stream 6,000 ML dam on Hebe River or Borradale Creek;
2. Two pump stations (Flowerdale River and Inglis River);
3. A 11 kilometer distribution pipeline for Myalla – Moorleah and Flowerdale; and
4. A riparian release on the Inglis River.

Hydrological Analysis

The potential future demand for irrigation across the concept area is 17,838 ML. This volume has been derived by assuming an application of 2.5ML/ha across the identified irrigable land. There is currently 7,017 ML allocated via water licences with DPIPWE across the area. Hence the potential unmet demand for additional irrigation is considered to be 10,821 ML.

The Water Assessment Tool indicates that natural inflows to the Hebe River dam would yield 2,069 ML at a Surety 5 level. The Water Assessment Tool indicates that natural inflows to the Borradale Creek dam would yield 1,196 ML at a Surety 5 level. The Water Assessment Tool indicates that 6,293 ML of winter water is available at a Surety 5 Level for the Flowerdale River.

Dams are likely to need to feature significant carry-over capacity to maximise yield from natural inflows. Further work is required to determine the balance of reliable yield from inflows to the need to pump-fill from the Flowerdale River during winter. With the current concept proposing a volume of 3,000 ML and available flows in the Flowerdale, it is anticipated only modest pump station capacities will be required to harvest required flows given the strong baseflows in the catchment.

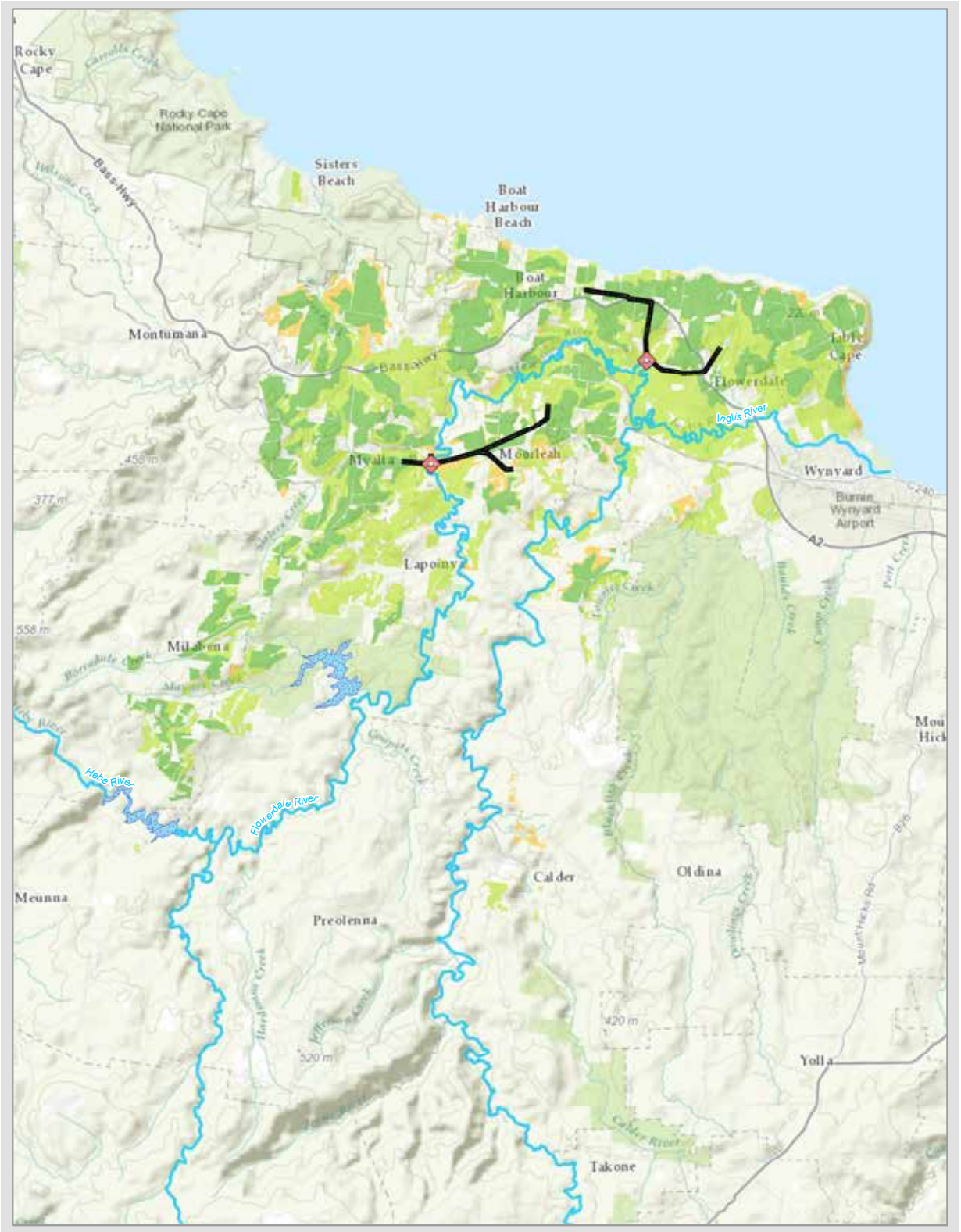
Environmental Overview

Desktop analysis indicates that both proposed dam sites are identified as potentially important locations for the giant freshwater crayfish. The Heber River site is potentially critical habitat for the species. There are also numerous records of other threatened species such as the Tasmanian devil, spotted tail quoll and grey goshawk at both sites. Both dam sites are forested and are likely to provide important landscape linkages for wide ranging species. The Borradale dam site also includes a portion of the Flowerdale River Regional Reserve.

Detailed flora and fauna assessments will need to be completed to ensure that there are no significant impacts on threatened species.

As the concept proposes to extract available winter flows it is unlikely that there will be any impacts on the aquatic values within the Flowerdale or Inglis rivers during the operation of the scheme. However, cease to take limits will need to be set to ensure that there are no impacts on species such as the giant freshwater crayfish.If water is to be conveyed down the Flowerdale River, transmission loss studies will also need to be completed.

Total capex $M	Opex ($/ML)	Est. Net Margin	NPV
$10.9	$81/ML	$550/ML	$3,074/ML



Concept Summary Report - Pipers

Volume (ML)	Irrigable Area (ha)	Storage capex $M	Distribution capex $M
2,500	18,013	$6.8	$3.5

Background

The Pipers River concept provides an opportunity to deliver a 2,500 ML supply of high reliability water to an irrigation district with good land capability and potential for expansion and diversification. The concept involves the construction of a dam on Montgomery Creek that would be filled via natural inflows and supplementary water pumped from the Pipers River in winter. Irrigation water would be supplied via pipelines and riparian takes along the Pipers River. There are extensive areas of land within the concept area that could be developed sustainably under irrigation as 18,013 hectares have been assessed as being suitable for irrigation across the concept area.

Example Enterprises

- Livestock
- Wine grapes
- Broadacre cropping including poppies, cereals
- Fruit and vegetables
- Wool
- Fodder
- Dairy

Proposed Infrastructure

The concept will involve the construction of:

1. An off-stream 3,000 ML dam on Montgomery Creek;
2. A pump station on the Pipers River to capture winter flows;
3. A transfer pipeline from the Pipers River to the Montgomery Creek dam site;
4. An 18 kilometer pipeline distribution network to the areas of Lilydale, Karoola and Turners Marsh; and
5. A riparian outlet to the Pipers River.

Hydrological Analysis

The potential future demand for irrigation across the concept area is 45,033 ML. This volume has been derived by assuming an application of 2.5ML/ha across the identified irrigable land. There is currently 1,380 ML allocated via water licences with DPIPWE across the area. Hence the potential unmet demand for additional irrigation is considered to be 43,653 ML.

The Water Assessment Tool indicates that natural inflows to the dam total 460 ML at a Surety 5 level. The Water Assessment Tool indicates that 12, 233 ML of winter water at a Surety 5 Level is available in the Pipers River. Whilst the preliminary water yield assessments indicate that a suitable volume of water is available further seasonal and daily analysis is required as inflows to the dam and within the Pipers River may be highly variable due to easterly weather influence and rain shadows that exist to the west.

Detailed modelling, including daily, takes is required to determine the optimum combination of dam and pump station capacities to achieve a reliability of 95%.

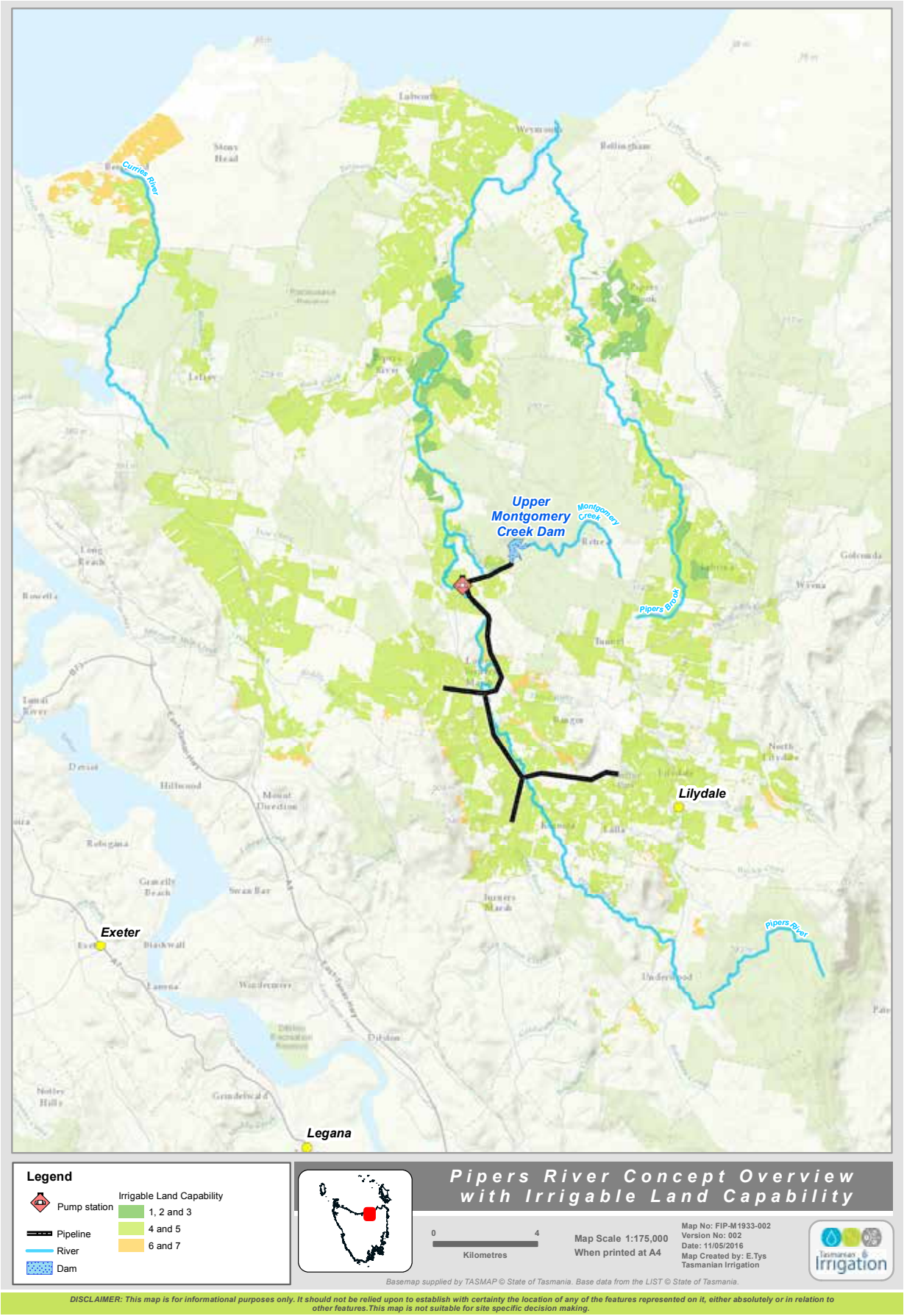
Environmental Overview

A desktop analysis of the Montgomery Creek dam site indicates that agricultural land and plantations cover 66% of the construction footprint. There are no threatened vegetation communities at the site with the 24 hectares present consisting of a Eucalyptus dry forest and Acacia. There are no records of threatened flora or fauna species at the site.

Detailed flora and fauna assessments will be required for the dam footprint and transfer pipeline to ensure that there are no significant impacts on threatened flora and fauna. However it is anticipated that the standard controls implemented by TI during construction and operation will mitigate any impacts on environmental values.

As the concept proposes to extract available winter flows it is unlikely that there will be any impacts on the aquatic values within the Pipers River during the operation of the scheme. However, aquatic impact assessments will need to be completed to ensure that the delivery and extraction of water does not have any impacts on aquatic values within the Pipers River. Transmission losses will also need to be determined for the section of the Pipers River that water will be delivered.

Total capex $M	Opex ($/ML)	Est. Net Margin	NPV
$10.3	$139/ML	$800/ML	$495/ML



Concept Summary Report - Tamar

Volume (ML)	Irrigable Area (ha)	Storage capex $M	Distribution capex $M
4,000	22,992	$14.7	$13.1

Background

The Tamar concept provides an opportunity to deliver a 4,000 ML supply of high reliability water to an irrigation district with good land capability and potential for expansion and diversification. The concept involves the construction of a 4,500 ML dam at Upper Muddy Creek that would be filled via a winter water supply agreement with Hydro Tasmania from the Trevallyn Dam. Irrigation water would be supplied via pipelines under gravity to areas of the Tamar Valley during a summer irrigation season. There are extensive areas of land within the concept area that could be developed sustainably under irrigation as 22,992 hectares have been assessed as being suitable for irrigation across the concept area.

Example Enterprises

- Livestock
- Broadacre cropping including poppies, cereals
- Fruit and vegetables
- Wool
- Fodder
- Dairy
- Wine grapes

Proposed Infrastructure

Three dam sites, Upper Muddy Creek, Four Springs and Pipers Lagoon Creek, were assessed for storage ratio capital and operational expenditure. All options had similar storage ratios and capital costs however the Upper Muddy Creek site offers the lowest operational expenditure. Hence it has been selected as the preferred storage site at this stage.
The concept will involve the construction of:

- An off-stream 4,500 ML dam on Upper Muddy Creek;
- A pump station at Trevallyn Dam;
- A transfer pipeline from Trevallyn Dam to the Upper Muddy Creek dam site; and
- A gravity fed 70 kilometer pipeline distribution network to irrigation areas in the Tamar Valley.

Hydrological Analysis

The potential future demand for irrigation across the concept area is 57,480 ML. This volume has been derived by assuming an application of 2.5ML/ha across the identified irrigable land. There is currently 3,840 ML allocated via water licences with DPIPWE across the area. Hence the potential unmet demand for additional irrigation is considered to be 53,640 ML.
Modelling indicates that 10,000 ML of winter water is available at Trevallyn Dam. As Trevallyn Dam is managed by Hydro Tasmania within a Hydro Water District, an agreement with Hydro Tasmanian will be required to approve and transfer the water rights to TI.
Detailed modelling including daily takes, is required to determine the optimum combination of dam and pump station capacities to achieve a reliability of 95%.

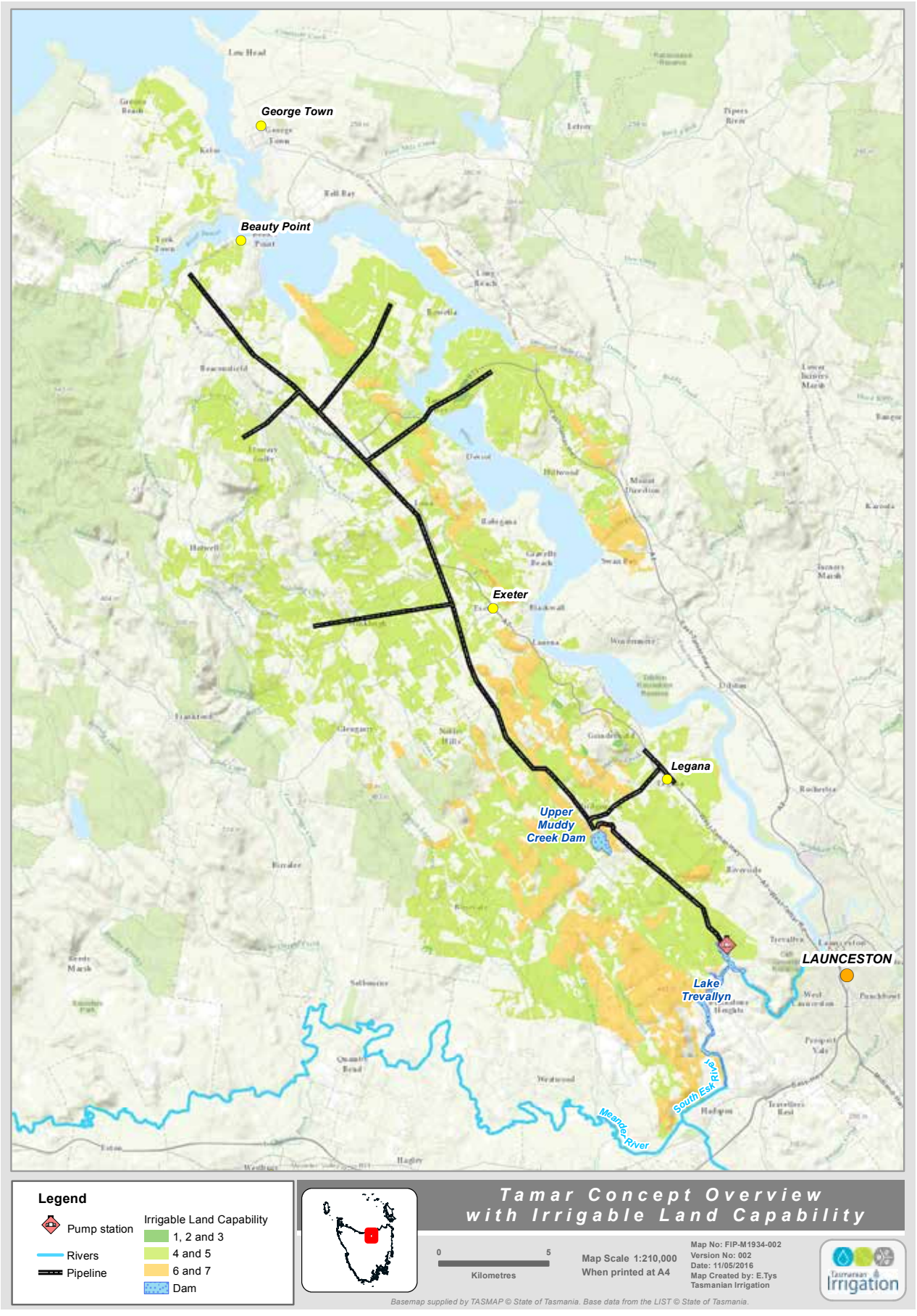
Environmental Overview

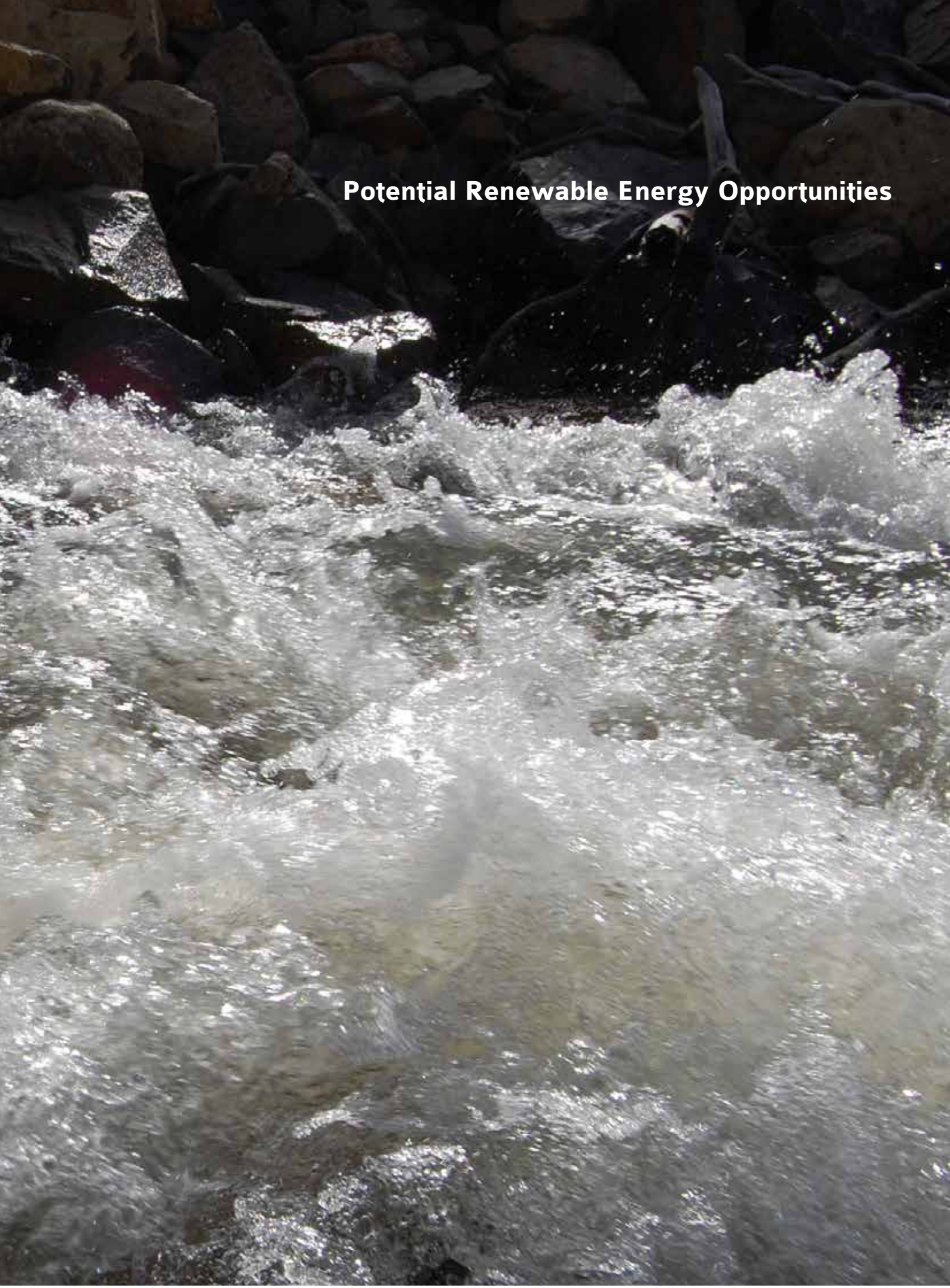
A desktop analysis of the Upper Muddy Creek dam site indicates that plantations and non threatened eucalypt forest cover 82% (50 ha) of the dam site. There is 5 hectares of threatened Eucalyptus amygdalina on sandstone within the dam site. There are no records of threatened flora or fauna species at the site.

Detailed flora and fauna assessments will be required for the dam footprint, transfer and distribution pipeline to ensure that there are no significant impacts on threatened flora and fauna during construction.

As the concept proposes to extract available winter flows it is unlikely that there will be any impacts on the aquatic values within the Trevallyn Dam during the operation of the scheme. However, aquatic impact assessments will need to be completed to ensure that the extraction of water does not have any impacts on aquatic values within the Trevallyn Dam or South Esk River.

Total capex $M	Opex ($/ML)	Est. Net Margin	NPV
$27.8	$168/ML	$900/ML	$3,299/ML





Potential Renewable Energy Opportunities

Potential Renewable Energy

Background

TI has previously investigated at a high level the potential for development of renewable energy opportunities, predominantly in the form of small hydro power. The primary focus of this investigation was to identify opportunities to generate energy that would reduce the operating costs of existing or potential future schemes. All of these potential opportunities fell into one of the four categories below:

1. Add hydropower to existing and operating schemes
2. Include hydropower in new scheme design
3. Develop hydropower at new "Greenfields" locations
4. Promote the development of micro-hydropower by private landowners

Opportunities identified in the first three categories above have the potential to reduce delivery costs for irrigators and to reduce TI overhead charges. As identified in the previous study the financial success of these hydropower opportunities is highly sensitive to the value of power generated. Tasmania has a relatively low wholesale cost of electricity that makes it difficult for small hydropower to be economically feasible if the power is sold based on the value of energy alone. If a power station can offset the owner's electrical demands at a retail rate, the project has a much higher likelihood of economic viability, however these opportunities are relatively rare in TI schemes, both existing and proposed. It was on this basis and as per the Business Plan, the Future Irrigation Project focussed on investigating further the opportunity for development of on farm micro hydro as part of the Future Irrigation Project.

Implementation

TI believe opportunity exists to investigate technologies that could be implemented by irrigators to utilise excess pressure provided by some of TI's schemes to generate power and reduce costs, and in some cases eliminate the need for on farm diesel generators. This opportunity has the potential for securing funding from Australian Renewable Energy Agency (ARENA) to investigate further, and TI is looking to set up a micro hydro demonstration project to progress this.

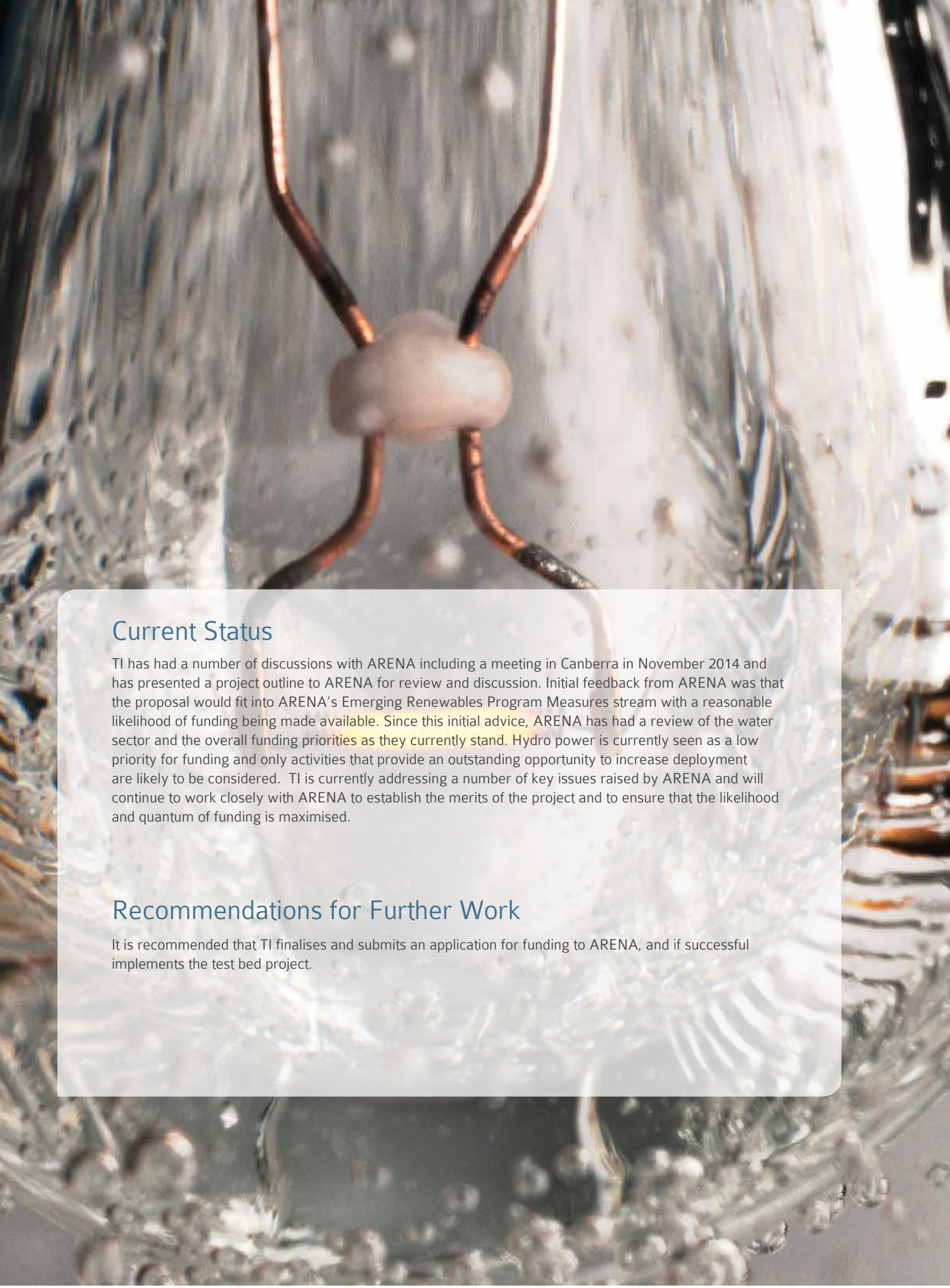
The aim of this project is to demonstrate micro hydro technology relevant to on farm irrigation systems. This would be done at a dedicated test bed facility to be located at Floods Creek Pump station as part of the Midlands Water Scheme, with potential for a second stage test of suitable equipment in an on farm system.

TI have investigated the current technology available both within Australia and internationally and have identified a number of suppliers who have shown an interest in taking part in this project.

Technical Details

For the test bed facility "Pumps as turbines" (PAT's) are likely to be the most economical solution for on farm energy recovery at pivots and dam releases. PAT's are essentially pumps designed to run in reverse as small generators with simple controls and fixed speed operation. This technology is being utilised at a number of pivot sites in Colorado and Oregon as well as finding application as pressure reduction in water treatment plants and existing pressure reducing valve locations. PAT's can be standardised with the use of hydraulic control valves which will be the key to cost reduction and allowing better possibility of commercialisation and scale of rollout.

The likely specifications for this equipment would have available heads of 10-30m with flows in the region of 5-10ML/day. This would achieve a net generation range of 3-30kW. TI estimates that for a standard 50-60ha pivot running 8mm packs with 20m of additional head available at the pivot centre would generate 11,000kwhr per annum. This annual generation is similar to what would be achieved with a 10kW photo-voltaic solar system. As such the capital cost for commercial deployment of on farm micro hydros will need to be similar to solar to be viable. This is a key barrier that will need to be addressed in the equipment selection as part of the test bed project.



Current Status

TI has had a number of discussions with ARENA including a meeting in Canberra in November 2014 and has presented a project outline to ARENA for review and discussion. Initial feedback from ARENA was that the proposal would fit into ARENA's Emerging Renewables Program Measures stream with a reasonable likelihood of funding being made available. Since this initial advice, ARENA has had a review of the water sector and the overall funding priorities as they currently stand. Hydro power is currently seen as a low priority for funding and only activities that provide an outstanding opportunity to increase deployment are likely to be considered. TI is currently addressing a number of key issues raised by ARENA and will continue to work closely with ARENA to establish the merits of the project and to ensure that the likelihood and quantum of funding is maximised.

Recommendations for Further Work

It is recommended that TI finalises and submits an application for funding to ARENA, and if successful implements the test bed project.

Appendices

Appendix 1: Stage 1 Opportunities Investigated

Opportunity Type - Location - brief description
Interconnectivity
Don - Forth
Meander Valley
Pipeline link from Great Lake to Meander Dam
Meander Valley
Pipeline link from Poatina Tailrace to Meander Valley
Melton Mowbray
Supply region via augmented MWS or link to Craigbourne Dam
Macquarie Cressy-Longford
Increase available water by augmenting/linking existing schemes
Central Tasmania Long term vision
Increase Great Lake inflows to create mega-storage for hydropower and irrigation
Enhancement
Cressy Longford
Remove flow constraints on CLIS Main Channel and West Channel to increase peak capacity
Dial Blythe
Dial Blythe Irrigation Scheme enhancement - increased dam size and additional pipeline
Hagley
Augment Hagley pipelines (HIS) via pump upgrades and new pipes
Kindred - North Motton
KNMIS Stage 2: Add 4 x boost pumps to increase capacity to 4,000ML
Kindred - North Motton
KNMIS Stage 3: Duplicate wet well and rising main between Forth River and Sprent Dam
Meander Valley
Minimise conveyance losses for GMID riparian deliveries
Meander Mini Hydro
Optimise operation of mini hydro to reduce spill and increase revenue
Sassafras - Wesley Vale
Enhance SWIS: upgrade pump stations to proportional pressure control
Sassafras - Wesley Vale
Stage 2 - Augmentation of SWIS: adding pipelines and / or additional dam storage
Whitemore
Augment WHS via new 5,000ML dam + pipelines
Lake Leake
Augment Lake Leake to increase capacity
New Development
Black River - Mawbanna

Cam - Elliot
Dam storage in Ridgely area, south of Burnie
Circular Head
Construct Harcus scheme (sub-scheme of original CHIS)
Circular Head
Construct Redpa scheme (sub-scheme of original CHIS)
Cressy Longford
Build ~10,000 ML dam at Creekton Flat to increase CLIS reliability during Poatina outages
Cygnet
Augment old town water supply dams to provide irrigation supply
Dalrymple - Pipers Brook
New pipelines from existing Curries Reservoir
Derwent Valley
Build pipelines from Hydro dams to areas of demand
Detention River catchment
Dam on or near Detention River
Fingal Valley
Dams (some existing), summer release to South Esk
Flowerdale - Wynyard - Table Cape
Build dam to capture winter flows plus pumps/pipes to distribute in summer
Hampshire
Pump-fill Talbots Lagoon from Arthur River to supply dairy conversion & possibly other areas on NW coast.
Little Swanport - Triabunna
Dam and pipelines from Little Swanport River, Tooms Lake or Prosser River
Natone - Moorville
Build new dam, pipes, pump, potentially join DBIS, 2,500ML+
Nubeena
Build dam on FEA land to supply Tassal and nearby vineyards/orchards.
North West Bay
Construct storage to supply aquaculture and/or agricultural enterprises
Ouse - Hamilton
Variations of Hydro 'Ouse pump-back scheme'
Tamar Valley
New scheme to supply Tamar Valley from either Meander River or Trevallyn. Dam.
Sheffield - Don
Build pipelines to distribute water from Hydro dams in Forth catchment
Sassafras - Wesley Vale
Stage 3 Augmentation of SWIS: adding 3,000 ML dam
Southern Midlands
Lake Tiberias: Investigate potential storage options.
St Pauls
Re-visit Meadstone Dam (or alternative dam sites) proposal

Appendix 2: Methods applied during the Stage 2 Investigation process

ASSESSMENT	METHOD
Hydrology assessment	The Tasmanian Water Assessment Tool (WAT) was used to determine yields available during summer and winter at a Surety 5 Level of notional reliability. Inflows to identified dam sites were assessed as well as potential water availability via pump diversion locations on rivers. In catchments where large volumes of the yield are attributed to flood events, daily flow analysis of long term streamflow records was completed. This analysis was used to inform pump size capacity and daily pumping thresholds.
Land use capability	A desktop analysis of land capability was completed using available land capability datasets. These were 1:100000 scale LIST land capability, 1:25000 – 1:100000 scale ALUM (Australian Land use Mapping) and farm scale (1:10000-1:25000) land capability data capture as part of the Farm Water Access Planning process. Where two datasets were available for an area, the dataset with the highest resolution was applied. Land capability maps were generated using ArcGIS.
Dam site selection	The standard TI dam site storage ratio was applied to determine dam site selections. The ratio compares dam embankment volume (m3) to dam impoundment volume (ML). A ratio of 1:10 is considered marginal, a ratio of 1:20 is considered good, and a ratio of 1:50 is considered very good.
Environmental risk assessment	A desktop analysis of environmental values at each of the dam sites investigated was conducted using the Natural Values Atlas and the TASVEG dataset. Vegetation maps were generated using ArcGIS. An impact assessment was completed that looked at direct site impacts and regional landscape linkage impacts.

Appendix 3: Methods applied during the Stage 3 Analysis process

ASSESSMENT	METHOD
Farm enterprise margins	Based on preliminary estimates of the enterprise mix per region. Margin data was cross checked between similar regions and enterprises from previous TI scheme business cases.
Capital expenditure (Capex)	Capex was calculated utilising engineering models from previous TI projects and concept designs.
Operating expenditure (Opex)	Operational data and engineering models from existing TI schemes was applied. Pumping, asset renewal and 'overhead' management costs have been estimated on scheme type, location and infrastructure.
Net Present Value (NPV)	Simplified NPV analysis has been calculated to provide a dollar figure per ML of water. NPV calculations considered expected capital expenditure and operational costs to the expected scheme enterprise margins for the region. Assumptions applied were: • Discount rate = 6% (real) • Assessment period = 40 years • Year 1 assumed 70% of construction capex incurred • Year 2 assumed remaining 30% of construction capex incurred • Years 3-40 assumed benefit equal to scheme capacity: (ML) x (net margin – opex) • Take-up of water is zero for first two years (during construction), then 100% for years 3-40 • No residual asset value. NPV calculations are within +/- 30%, which is in-line with the expected accuracies of the capex/opex/margin estimates used as inputs. Accordingly results should be used as an indicator of likely scheme viability only.

Appendix 4: Concepts identified during Stage 2 Investigations

Concept name	Opportunity type	Region	Concept volume (ML)	Potential irrigable area (ha)	
Forth - Don	Interconnectivity	North West	1,400	2,381	
Macquarie - Cressy	Interconnectivity	North	14,000	56,461	
South East Integration	Interconnectivity	South	-	-	

	Opportunity description	Opportunity constraints	Recommendation for further investigation y/n
	The Forth – Don concept provides an opportunity to supply irrigation water to areas between the Forth River and Don using a combination of new and existing infrastructure (Forthside Irrigation Scheme and TasWater). Land capability analysis indicates that close to 50% of the proposed irrigable area identified for the concept is prime agricultural land. The concept proposes to construct a dam on Ayres Creek that would be filled via a pipeline from the Forth River. The concept was suggested via the community consultation process.	Detailed engineering of the potential capacity and costs of utilising existing pipelines is required. The concept is not recommended to proceed to further investigations as construction costs are potentially in the order that private investment would cover the cost of construction.	**N**
	The Macquarie – Cressy concept presents an opportunity of securing a water source with high reliability into an irrigation district that has very high land capability potential. The concept has the potential to supply water to new areas south east of Poatinna and within the Lake River, Isis River and Macquarie River areas. The scheme would also have the potential to augment existing irrigation areas within Cressy, Whitemore, Macquarie Settlement and Brumbys Creek. The concept proposes to capture winter flows within a dam on the lower Lake River then deliver the water for irrigation via a gravity fed 30 km pipeline. The concept was put forward during the TFGA community consultation process.	A water supply agreement would need to be secured with Hydro Tasmania. The concept proposes to transfer water into the Lake River and Isis River. Transmission losses would need to be determined to ensure that this was viable. Detailed flora assessments would need to be completed for pipeline infrastructure to ensure that there were no significant impacts on threatened species.	**Y**
	The South East Integration concept provides an opportunity to link the recently completed South East Irrigation Scheme (SEIS) 3 scheme with the older SEIS 1 and SEIS 2 schemes. The SEIS 3 scheme has the ability for additional supply to SEIS 2 when Rekuna Dam is not being refilled. The concept also proposes to consider providing SEIS 3 water to areas north of Campania and the Coal Valley via a new pipeline. In investigating this concept further, specific consideration will be given to the impact of any augmentation to the commercial and reliability aspects of existing entitlements. The area has good land capability and existing high value agricultural businesses in place that are limited by water availability.	The water to be supplied is from the SEIS 3. To ensure compliance with the approvals for this scheme, any water that is applied via the new connection would need to be done under a Farm Water Access Plan. Detailed engineering and flora and environmental assessments of the pipelines for both options need to be completed.	**Y**

Appendix 4: Concepts identified during Stage 2 Investigations

Concept name	Opportunity type	Region	Concept volume (ML)	Potential irrigable area (ha)
Southern Midlands	Interconnectivity	South	11,000	33,407
Cressy Augmentation	Enhancement	North		
Lake Leake – Elizabeth River	Enhancement	North	1,480	6,337

	Opportunity description	Opportunity constraints	Recommendation for further investigation y/n
	The Southern Midlands concept presents an opportunity to deliver a long term vision to provide a secure water supply into the Southern Midlands. The concept proposes to construct a 57km pipeline that will connect areas within the Southern Highlands and Midlands Irrigation Districts. High reliability water for the scheme would be sourced from Lake Echo via an agreement with Hydro Tasmania then stored within the existing Hydro Tasmania owned Dee Lagoon. Water would be delivered during a summer irrigation season. There is potentially a high demand for the scheme with the Southern Highlands Irrigation Scheme and the Jordan River Line of the Midlands Water Scheme both being 100% subscribed.	A water supply agreement would need to be secured with Hydro Tasmania. The concept proposes to transfer water into the Jordan River. Transmission losses and salinity within this section of the river may make this option unviable. Detailed flora assessments would need to be completed for pipeline infrastructure to ensure that there were no significant impacts on Lowland Native Grasslands or threatened species.	**Y**
	The Cressy Augmentation concept proposes to remove current flow constraints on the existing Cressy Longford Irrigation Scheme (CLIS) Main and West channels. The channel constraints identified during assessment were siphons and crossings that require augmentation or replacement. Site investigations indicate that substantial improvements could be achieved by simply scouring and cleaning up the canal approaches and discharge points. The approach could achieve the outcomes without incurring major capital costs. CLIS currently has a water supply agreement with Hydro Tasmania for 25,000 ML however channel constraints mean that this volume can not be delivered during optimal off peak pumping periods. The concept proposes to work with CLIS to remove these channel constraints	Channel scouring may not be sufficient to increase channel capacity to the desired level. A capital augmentation program would then be required. The scheme currently provides a through-flow of approximately 30,000 ML with water delivery of approximately 15,000 ML to irrigators, making the supply system only 50 % efficient. This is due to the majority of irrigators pumping during off peak tariff periods.	**Y**
	The Lake Leake – Elizabeth River concept assessed the opportunity of augmenting summer flows from Lake Leake to provide a high reliability water supply to Elizabeth River landholders. Investigations reviewed previous proposals such as raising Lake Leake and constructing a dam at Chimney Hill. A potential new dam site was assessed at Davidsons Hill.	Hydrological investigations indicate that the Chimney Hill dam only provides 900 ML at a surety of 70% once environmental flows established by Freshwater Systems in 2003 are factored into water availability. The off-stream Davidson Hills dam site was investigated downstream of the Chimney Hill site, however yield was again found to be inadequate for a viable scheme. The Water Assessment Tool determined that approximately 1,480 ML may be available at Surety 5 level. The concept is not recommended to proceed to further investigations as hydrological investigations determined insufficient yield within the Elizabeth River to provide a reliable water resource.	**N**

Appendix 4: Concepts identified during Stage 2 Investigations

Concept name	Opportunity type	Region	Concept volume (ML)	Potential irrigable area (ha)	
Meander Optimisation	Enhancement	North			
Sassafras Wesley Vale Augmentation	Enhancement	North West	1,805	9,000	
Black River - Mawbanna	New development	North West	3,000	9,561	

	Opportunity description	Opportunity constraints	Recommendation for further investigation y/n
	The Meander Optimisation concept presents an opportunity to sell unsold water entitlements held within the existing Meander Dam. The concept proposes to enhance existing pipelines across the irrigation district for the purpose of increasing operational capacity and efficiencies of the existing scheme. The existing Meander Pipelines (Caveside, Hagley, Quamby and Rubicon) have been physically reviewed to assess hydraulic performance and to identify areas of potential enhancement. Findings indicate that pipe condition is good with sufficient capacity to provide additional water. The main constraints identified were river intake screens, pump station size and associated controls. The concept has the potential outcome of selling unsold water entitlements within Meander Dam.	The finalisation of the hydrological model and associated transmission losses for the Meander River is required to inform design options and water available for pipeline delivery.	**Y**
	The Sassafras Wesley Vale (SWIS) Augmentation concept presents an opportunity to increase the operational capacity and efficiency of the existing fully subscribed SWIS scheme. The concept proposes to install four new boost pump stations and construct a storage dam that would be filled with excess winter flows. The concept would provide to the Aldersons, Pardoe, Northdown and Sassafras zones within the current irrigation district.	Water availability will need to be assessed under the Mersey Water Management Plan. Any infrastructure placement would need to be assessed for impacts on central north burrowing crayfish and green and gold frogs. Further investigations are required to determine the best placement of the dam site.	**Y**
	The Black River – Mawbanna concept investigated an opportunity to construct a dam on Blackfish Creek to provide high reliability summer water to the Mawbanna district. Land capability potential across the identified scheme area is high and water reliability is high with the Water Assessment Tool identifying that 13,800 ML is available at a Surety 5 level. Dairy is currently the main enterprise present across the concept area.	Desktop analysis for flora and fauna impacts indicate that the Black River and Blackfish Creek are considered as critical habitat for the giant freshwater crayfish. The Blackfish Creek dam site is entirely vegetated, 160 hectares in total, and is highly likely to provide nesting habitat for the grey goshawk. There is also potential for the site to provide denning habitat for Tasmanian devils. The concept is not recommended to proceed to further investigations as the environmental impacts are considered too high.	**N**

Appendix 4: Concepts identified during Stage 2 Investigations

Concept name	Opportunity type	Region	Concept volume (ML)	Potential irrigable area (ha)	
Cam - Elliot	New development	North West	3,000	9,561	
Detention River	New development	North West	3,000	3,080	
Fingal Valley	New development	North	7,200	14,507	

	Opportunity description	Opportunity constraints	Recommendation for further investigation y/n
	The Cam Elliot concept investigated an opportunity to construct a dam on Sandersons Creek to provide high reliability summer water to the areas of Elliott, Mt Hicks and Ridgely. Land capability potential across the identified scheme area is high with 43% of identified irrigable land being classed as prime agricultural land. Dairy is currently the main enterprise present across the concept area.	Hydrological investigations indicate that inflows to the dam would only yield 735 ML annually. Hence the majority of water stored within the dam would need to be pumped from the Cam River in winter. Whilst there is available yield in the Cam River the lift from the river to the dam site is at least 100-150 metres. The operational cost of pumping from the Cam River has been calculated as very high $130/ML. Total operational costs have been determined to be around $214/ML. The Net Profit Value (NPV) for the concept was calculated at $107/ML. The concept is not recommended to proceed to further investigations as the calculated NPV indicates the net economic benefit of the scheme is likely to be marginal.	**N**
	The Detention River concept presents an opportunity to provide an additional 3,000 ML of water into an established dairy area. The concept proposes to construct a dam on the Alarm River and deliver water via natural watercourses during a summer irrigation season. Land capability potential across the identified scheme area is high with nearly half the identified irrigable land being classed as prime agricultural land	The proposed dam situated on a tributary of the Detention River. Desk top analysis indicates that the site is a potentially important location for the giant freshwater crayfish. There are also numerous records of other threatened species such as the Tasmanian devil and grey goshawk. The dam site is a mosaic of grassland and vegetation with the threatened vegetation community Riparian Scrub present within the dam footprint. Detailed flora and fauna assessments will need to be completed to ensure that there are no significant impacts on threatened species. Hydrological analysis indicates that annual yields may be marginal. Hence a detailed reliability assessment is required.	**Y**
	The Fingal Valley concept provides an opportunity to deliver a supply of high reliability water to an irrigation district upstream of the existing Lower South Esk Irrigation District. The concept involves the construction of a dam on Pig Creek that would be filled via a winter take from the South Esk River. Irrigation water would be supplied via riparian takes along the South Esk River. There are extensive areas of land within the concept area that could be developed sustainably under irrigation.	Water availability will need to be assessed under the South Esk Water Management Plan. As the concept area is within a Hydro Water District an agreement with Hydro Tasmanian will be required to transfer the water rights to TI. Demand for irrigation expansion would need to be assessed.	**Y**

Appendix 4: Concepts identified during Stage 2 Investigations

Concept name	Opportunity type	Region	Concept volume (ML)	Potential irrigable area (ha)
Flowerdale	New development	North West	3,000	7,135
Hampshire	New development	North West	4,500	24,659
Pipers River	New development	North	2,500	18,013
St Pauls	New development	North	4,500	8,592

	Opportunity description	Opportunity constraints	Recommendation for further investigation y/n
	The Flowerdale concept provides an opportunity to provide a high reliability water source into a highly productive irrigation area. Land capability analysis indicates that close to 50% of the proposed irrigable area identified for the concept is prime agricultural land. However, current growth across the area is limited by the availability of suitably sized on farm dam sites. The concept proposes to construct an instream dam on either Borradale Creek or the Hebe River. The dam would be filled with excess winter flows from the Flowerdale River. The concept has strong community support with expressions of interest for 3,631 ML already received.	Desktop analysis indicates that both proposed dam sites are identified as potentially important locations for the giant freshwater crayfish. There are also numerous records of other threatened species such as the Tasmanian Devil and Grey Goshawk at both sites. Both dam sites are forested with the Borradale dam site including a portion of the Flowerdale River Regional Reserve. Detailed flora and fauna assessments will need to be completed to ensure that there are no significant impacts on threatened species.	**Y**
	The Hampshire concept investigated an opportunity to convert an area currently under plantation forestry into dairy. The concept proposed to utilise the existing Talbots Lagoon as a winter storage dam to deliver summer irrigation water via the Wey River and a pipeline network to the areas of Gatcombe Plain and Hampshire.	The area to be irrigated is currently under plantation forest and would need to be converted to irrigable land. Estimated NPV is low due to moderate land capability and likely low net margins. On this basis the concept is not recommended to proceed to further investigations as it is viewed as a longer term vision compared to other concepts investigated.	**N**
	The Pipers River concept presents an opportunity to provide a supply a high reliability water into an area with good land capability and potential for expansion and diversification. The concept involves the construction of a dam on Montgomery Creek that would be filled via natural inflows and supplementary water pumped from the Pipers River in winter. Irrigation water would be supplied via pipelines and riparian takes along the Pipers River.	The dam site is located within a landscape mosaic of plantations, agricultural land and remnant vegetation. Detailed flora and fauna assessments will need to be completed to ensure that there are no significant impacts on threatened species. Hydrology across the area is highly variable due to easterly weather influences. Hence an extensive hydrology and reliability assessment will be required.	**Y**
	The St Pauls concept assessed the opportunity of to provide a high reliability summer water supply to St Paul and South Esk River landholders. Investigations reviewed the previous Meadstone Dam and St Pauls at Benham and Hop Pole Creek concepts. The Hop Pole Creek concept was preferred as it has a high storage ratio and was not sited on a major river.	The Hop Pole Creek dam site would store approximately 10,000 ML however the Water Assessment Tool outlines that there is insufficient water at Surety 5 levels to fill the dam. Only 524 ML would be captured via natural inflows meaning that the remaining volume would need to be pumped from the St Pauls River. A total of 4,979 ML is currently available at a surety 5 level. The concept is not recommended to proceed to further investigations as hydrological investigations currently indicate that there is insufficient yield within the St Pauls River to provide a reliable water resource.	**Y**

Appendix 4: Concepts identified during Stage 2 Investigations

Concept name	Opportunity type	Region	Concept volume (ML)	Potential irrigable area (ha)	
Little Swanport	New development	North	1,800	12,051	
Tamar	New development	North	4,000	22,992	

	Opportunity description	Opportunity constraints	Recommendation for further investigation y/n
	The Little Swanport concept investigated an opportunity to construct a dam on Larges Creek to store winter flows from the lower section of the Little Swanport River. The concept investigated the delivery of high reliability summer water to irrigators between Triabunna and Buxton Point.	Hydrological analysis indicates that yield from the Little Swanport River would be unreliable hence significant carry-over capacity would need to be included into the dam design. However dam storage ratio analysis determined that the preferred dam site is inefficient with a storage ratio of only 9:1. Due to the limited hydrological capacity capital expenditure is extremely high $10,056/ML. Desktop analysis for flora and fauna impacts indicates that swift parrots forage at the site and two Conservation Covenant are located within the dam site. The concept is not recommended to proceed to further investigations as there is marginal hydrological reliability, capital expenditure costs are high and environmental impacts are considered.	**N**
	The Tamar concept identifies a new scheme that would deliver high reliability water into the Tamar Valley. The concept proposes to source winter water from Trevallyn Dam under a water supply agreement with Hydro Tasmania and hold it in a dam at Upper Muddy Creek. Water would be supplied by a gravity fed pipeline in summer. There are extensive areas of land within the concept area that could be developed sustainably under irrigation.	As the concept area is within a Hydro Water District an agreement with Hydro Tasmanian will be required to transfer the water rights to TI. Support within the wider community for the concept would need to be determined. There is a total of 35 hectares of vegetation within the dam site footprint with 5 hectares of threatened Eucalyptus amygdalina on sandstone present. Detailed flora and fauna assessments will need to be completed to ensure that there are no significant impacts on threatened species.	**Y**

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