

Environmental, cultural and social capital as a core asset for the Martuwarra (Fitzroy River) and its people



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Report prepared for

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1. Executive Summary

The Martuwarra (Fitzroy River) catchment is a place of outstanding natural and cultural significance, both to Traditional Owners and the broader Australian public.

The Western Australian Government is currently implementing an election commitment to ensure the health of the river and support sustainable economic development. Traditional Owners are also working together on the same goal through the Martuwarra Fitzroy River Council that represents most of the Native Title groups in the catchment.

Allocating water for irrigated agriculture is being investigated as a sustainable development option for the Martuwarra catchment. Through a benefit cost analysis, we find that irrigation enterprises are likely to be mostly unprofitable, create a poor return on public investment and create few jobs. This argument is supported by the review of past regional irrigation projects. Prospects for positive benefits in our analysis were limited to centre pivot irrigation from groundwater where high prices can be achieved, such as through targeting high value niche markets.

We also find that an inclusive benefit cost analysis would have to factor in costly negative public good externalities including increased carbon emissions from land clearing; reduced subsistence food provision and increased social welfare costs from lost social capital. Published evaluations to date haven't factored in these costs.

Through a review of the literature on Indigenous economic development we outline a development pathway based on developing the human, cultural and social capital of Martuwarra Traditional Owners and connecting the natural and cultural capital of the catchment with existing and emerging markets. Together with the existing pastoral and services base of the economy we find this represents a stronger pathway to sustainable development, economic growth and improved workforce participation than irrigation.

Through the collection of information on existing enterprise activity in the Martuwarra (Fitzroy River) catchment we find that Aboriginal enterprises in the region are already significant and responding to demands across a wide range of sectors in the regional economy. The sectors that the regional Aboriginal enterprises are already targeting have market demand worth in excess of \$245b and domestic industries with markets worth approximately \$234 – 344m. In some markets such as *Gubinge* (Kakadu plum) and Aboriginal tourism, industry growth is constrained by supply rather than demand. We find that public investment in research and development for Aboriginal enterprises lags significantly behind that spent on irrigation and pastoralism; with over \$35m in funding identified for research and development to support irrigation and beef industry growth compared to less than \$1m in similar funding for Aboriginal-led market sectors.

Finally, we make recommendations on how targeted public investment in direct job creation, human capital development, governance capacity and product marketing through economic development strategies co-designed with Aboriginal organisations and businesses can represent good investments with the potential to increase supply chain value capture by Aboriginal enterprises and create sustained regional economic growth.

2. Introduction

2.1 Background

The mostly unregulated river conditions across northern Australia's tropical savanna means that these systems are globally iconic. Representing the most biologically diverse and healthy aquatic ecosystems in Australia (Douglas, Jackson et al. 2011), it is one of the few larger regions worldwide to have a low level of threat to ecosystems from biodiversity perspectives (Vörösmarty, McIntyre et al. 2010) and the highest concentration of free-flowing rivers. The Martuwarra (Fitzroy River) is an exemplary case as one of the most megadiverse regions in the world. The 733 km long river has a catchment area of almost 100,000 km². A significant Indigenous population still lives in or around and is culturally connected to the Martuwarra catchment and make up the majority of people living in the region. They manage natural resources and draw subsistence and cultural and commercial benefit from activities related to a 40,000-year-old cultural connection to the country (land and water).

In 2016, representatives from regional native title groups concerned with the growing impacts of actual and proposed development along the Martuwarra catchment signed the Fitzroy River Declaration. In 2018 they formed the Martuwarra Fitzroy River Council to enact the declaration. The declaration describes the commitment of these groups to work together to manage and protect the Martuwarra catchment. Key premises include that native title holders: 1) should be at the centre of catchment management and related regional development planning; and 2) stand united to protect their traditional values in considering proposals related to land and water management.

In recognition, the Western Australia Government has committed to a catchment management plan which is to include a national park over parts of the Fitzroy and Margaret Rivers. The tremendous opportunity before the Martuwarra Fitzroy River Council and the Western Australian Government is to translate the principles and intent of the Fitzroy declaration into an effective management plan for the catchment, for the proposed national park, and for the wellbeing of local Aboriginal Traditional Owners and all people. In the meantime, proposals to dam or take water from the Martuwarra catchment continue to emerge, including proposals that could degrade conservation and Aboriginal socio-cultural values.

2.2 Report Overview

This document undertakes a review of the available development options with a focus on sustainable development that will benefit the Aboriginal majority in the Martuwarra catchment. Based on an analysis of the available evidence the report makes a case for the conservation of the iconic water body and its catchment. It describes why the economic and social values achievable by protecting and preserving the Martuwarra catchment are likely to be greater than any values associated with taking additional water. This is demonstrated to be especially true where irrigation development is likely to adversely impact the most significant environmental and cultural values that the river currently provides.

The case for alternative investment presented here is based on two arguments supported by evidence. One argument is that regional irrigation developments are likely to be mostly unprofitable, create a poor return on public investment and create few jobs. This argument is supported by the review of past regional irrigation projects in northern Australia and original work for this report to assess recent proposals for Martuwarra catchment irrigation development. The only irrigation that showed potential to return a positive BCA under realistic scenarios was smaller scale centre pivot irrigation from groundwater, but a positive return was reliant on high beef prices in the context of high value, premium products for well-defined end markets. The review also shows that irrigation development is likely to have destructive impacts on cultural and environmental values. Inclusive BCA would have to factor in costly negative public good externalities including increased carbon emissions from land clearing, reduced subsistence food provision and increased social welfare costs from lost social capital. We find that if such adverse impacts were included, the net benefit from many potential irrigation projects proposed for the region would be highly unfavourable. This is especially so for larger scales of irrigation development in local proposals.

Our second argument is that the investment to support already existing and growing Aboriginal-led enterprises in the region can create much higher returns on investment and employment than irrigation. Information gathered for this report shows that Aboriginal enterprises in the region are already significant and responding to demands across a wide range of sectors in the regional economy (appendix 2). This includes natural resource management, food, scientific knowledge, social services and cultural and nature-based tourism enterprises. This report focusses on emerging enterprises as a catalyst for market based regional economic growth. The sectors that the regional Aboriginal enterprises are already targeting have market demand worth in excess of \$245b, and domestic industries with markets worth approximately \$234-344m.

Importantly, our review also shows that Aboriginal-led enterprises typically operate consistently with Aboriginal aspirations for the preservation of ecological and cultural assets of their country. Consequently, supporting development through such enterprises is unlikely to lead to the kinds of externalities that irrigation investment often does.

One form of investment with well documented capacity to provide more direct Aboriginal jobs per dollar invested than irrigation is Aboriginal ranger programs. Furthermore, the documented evidence shows that such investments can have significant 'spin-off' benefits. These benefits include skills development, improved social well-being, reduced public social welfare costs and follow-on entrepreneurship and business creation.

The report concludes that:

1. Irrigation developments are likely to be mostly unprofitable, create a poor return on public investment and create few jobs. This argument is supported by the review of past regional irrigation projects.
2. Inclusive BCA would have to factor in costly negative public good externalities including increased carbon emissions from land clearing, reduced subsistence food provision and increased social welfare costs from lost social capital. Published evaluations to date haven't factored in these costs.
3. Plans for the region's land and water will more likely enable cultural and development goals if grounded in two paradigms: 1) the modern economy where knowledge, services and experiences rather than bulk commodity production are the most significant value-add activities and 2) traditional and living Aboriginal social and cultural values and connected to Traditional Owner management of land and water assets.
4. The potential demand for a diverse range of economic activities the Martawurra Traditional Owners can and already do offer spans a broad swathe of economic sectors.
5. Potential demand is large. For example, in two industries consistent with Martawurra catchment conservation: Aboriginal tourism and Gubinge (Kakadu plum), supply rather than demand is the constraint.
6. Accelerating realisation of greater market shares and returns in the markets already targeted can be enhanced by public investment.
7. Investment in direct job creation is one important avenue.
8. This is most prevalent in natural resource management but is also applicable in a broader set of labour-intensive sectors where there is a large and growing demand for services.
9. Realising the greatest potential benefit from such investment requires supporting investment in governance capacity, human and social capital.
10. Supply chain research and development and product marketing can represent good investments with the potential to increase supply chain value capture by Aboriginal enterprises.
11. We recommend developing and funding a strategy for targeted investment and support to grow the Martawurra catchment economy in partnership with Aboriginal organisations and in ways that are consistent with their values.

3. Past Northern Australian Irrigation Economics Findings

There is a long history of support for agricultural and irrigation development in the north of Australia. Several large irrigation schemes including the Ord and Burdekin River developments have been operational for some decades. This has allowed several detailed analyses of the economic cost and benefits. Some key findings pertinent to the proposed Martuwarra (Fitzroy River) irrigation developments are outlined below.

In the context of recent renewed Federal Government enthusiasm for further development in northern Australia, the Australia Institute report outlined the historical benefits and costs of the Ord River Irrigation area (Grudnoff and Campbell 2017). This report finds that between 1959 and 1991 the public accrued a financial loss of \$939m (in 2016 dollars), representing a return of 17 cents for every public dollar invested. Private investors made modest gains of \$32m during that period. From the years 1959 to 1991 the benefit cost ratio for the Ord development accounting for both private and public costs was in the order of 0.44. However, the public return was far worse, in the order of 0.17. This expenditure represents a significant transfer of wealth from taxpayers to private irrigators, with the justification being the public good of employment generation in the region. However, it is evident that little public good in the form of employment has been generated.

The repeated failure of more labour and input intensive agricultural industries in the region such as cotton and sugar demonstrate the infeasibility of the enterprises in the area on a cost of production basis. The fact that Sandalwood is now the largest single crop in the Ord both by measures of area grown and value is indicative of how the production of most irrigated bulk agricultural commodities is unlikely to be profitable in northern Western Australia. Whilst Sandalwood is profitable, it is a niche crop with limited expansion potential without flooding supply, leading to negative profits. Furthermore, Sandalwood generates less employment than many crops because for most of the tree's multi-year life it requires little labour, only requiring intensive labour at harvest.

Employment outcomes for Aboriginal people have often been expressed as a rationale for the Ord irrigation district. For example, it has been suggested as a direct employer and a buffer against the potential downsizing of other local industries, most prominently the Argyle mine. The Auditor General's report into the Ord expansion did note that considerable local Aboriginal employment and training opportunities were created during the construction of the Ord expansion. 200 Aboriginal people worked on the project construction phase, providing 21 percent of all labour. However, this has not been sustained. On an ongoing basis, the recent expansion of the Ord project created only around 60 jobs, at a cost of about \$6m per job and few of those employed are Aboriginal (Grudnoff and Campbell 2017).

This demonstrates that the development of agriculture in northern Australian areas is not necessarily linked to better long-term employment outcomes or increased economic participation for Indigenous people. In fact, (Stoeckl, Hicks et al. 2018) found in the Mitchell River catchment (Queensland) "a profound and asymmetric disconnect" between the Indigenous and non-Indigenous economies. For instance, increasing the incomes of Indigenous people raises the incomes of non-Indigenous people, but not vice-versa. Hopes for 'trickle down' benefits from agricultural development to Indigenous communities are likely to be misplaced (Stoeckl, Hicks et al. 2018).

Irrigation developments in northern Australia have also been chronically undersubscribed, underutilised and delivered over budget. All of this tends to lead to very poor returns on public investments. This was certainly the case for the initial Ord development. 70,000 ha was planned for cultivation, but the final scale was in the order of 12,000 ha with 5,000 ha actually used (Ash 2014). This trend of underutilisation and slow scale-up periods has continued with the Ord expansion in more recent times. For example, the WA Auditor General's report (W.A.A.G 2016) into the Ord expansion revealed that the expansion took 3 years longer to deliver than planned and cost \$114m more than anticipated. Now completed, the scheme remains largely underutilised. Of the 8,000 ha of land planned for development at Goomig, ultimately 7,000 ha was developed. However, as of 2016, only 1,600 ha was under crop. Underutilisation and cost blowouts significantly affect the long-term economic viability of irrigation areas. Furthermore, they can constrain the development of economies of scale necessary to justify further development. For example, small production volumes can limit the economic viability of processing facilities, transport networks and other local infrastructure. This can further slow irrigation project utilisation rate growth in an entrenched negative feedback loop.

Not only has much of the cost of the Ord development been borne by taxpayers as outlined above, but also much of the ongoing risk associated with the project continues to be carried by the public. The risks arise because initial plans for the Ord development to be owned by multiple small freehold titles failed when not enough proponents met the State's criteria (Grudnoff and Campbell 2017). The State then moved towards seeking a single developer, with Kimberley Agricultural Investment Pty Ltd (KAI) being selected in November 2012. The resulting reliance on a single large developer poses risks if the developer stops farming. The state and taxpayers may have to bear responsibility for environmental or infrastructure damage and could face costs related to finding new occupants for the land.

A history of the cost and benefit analyses for proposed irrigation in northern Australia starting with Davidson (1965) also finds low returns on public investment. More recently, Dent and Ward (2016) tested the thesis that if development was economically feasible the expenditure on irrigation infrastructure would be capitalised into land values. The study concludes that in the 'best case' scenarios every dollar of return from development would cost between \$1.10 and \$3.20 and in less optimistic scenario costs would exceed benefits by greater than tenfold. The report concludes that further taxpayer funding cannot be economically justified for irrigation development in northern Australia.

In looking at past developments in northern Australia, several common themes seem to drive repeated failure, underutilisation, and poor returns on investment. These include:

- Expansion plans were simply too ambitious.
- Forecast revenues relied heavily on direct subsidies (i.e. cotton), floor prices and quotas (i.e. tobacco) or single desk marketing arrangements (i.e. grains).
- Developments overestimated the economies of scale possible, as such input costs were higher than anticipated and cost of production pressures made farming uncompetitive.
- Failure to reach economies of scale meant local processing and supply chain facilities were not profitable and were either closed or not built, adding further to production costs, primarily through transport and other tyranny of distance factors.
- Insufficient capital was often budgeted to properly scale-up dryland farming or fully operationalise irrigation schemes.
- Unanticipated agronomic challenges such as pest and disease, varietal limitations and unfamiliarity of farmers with local conditions occurred.
- Distance detrimentally affected quality, both in high-value commodities and in high transport costs which burdened farming enterprises.

Whilst the Burdekin River development is likely the most successful development in the north of Australia, economic analysis of this project found a benefit cost ratio of only 0.65 (WWF 2014). Even this level of return is likely to be challenging in many other northern Australian contexts. This is because recreating the factors primarily responsible for this scheme's relative success has proven elusive in other developments including the Ord River scheme and are unlikely to be replicable in the Martuwurra (Fitzroy River). Unlike other irrigation schemes across northern Australia, there was already an established sugar industry and associated infrastructure at the time of development of the Burdekin Falls Dam (Ash 2014). Four sugar mills serviced the Burdekin region and mutually beneficial contractual arrangements were put in place with growers, guaranteeing a market for a number of years while the mills received a certain quota of sugarcane that ensured longer-term viability (Ash 2014). In so far as the history of irrigation developments in the north of Australia can be used as a guide for the future, it may be prudent to limit development to areas where existing industries exist (or are in close proximity), limit the scale and speed of the developments and use conservative estimates of revenues and costs to make the economic case.

4. Evaluating Benefits and Cost of Recent Proposals for Martuwarra (Fitzroy River) Irrigation Development

In recent times both the Federal government and individual businesses have put forward proposals for irrigation in the Martuwarra catchment. The proposals vary with respect to the size of the proposed development and the source of water proposed to supply irrigation. Original work for this report fully documented in Appendix 1 assessed benefit cost ratios for four scales of potential irrigation developments very similar to original study proposals.

4.1 Options Evaluated

Large Water Storages - Gogo Station Proposal

Gogo Station is a 370,000 ha cattle station in the Kimberley region of Western Australia. The agricultural operations are predominately extensive cattle grazing on native grasslands, with some fodder production taking place. The station operators have proposed a plan for irrigated agriculture including for fodder production and cropping. Through a staged development plan, the station has proposed up to 15,000 ha of furrow irrigation. To provide the required water, three 50,000 ML storages would be required.

Where possible, data and assumptions for this analysis were derived from a development plan and budget as presented by Gogo Station in their business plan. Large water storage development costs were also assessed for other river offtake and water storage options.

Details of data and assumption in this analysis can be seen in Appendix 1.

Gogo Station 50GL Development

In addition to the full 150GL, 15,000 ha development outlined in the Gogo Station proposal, a *scaled-back* development has been investigated that consists of a 50GL water storage and 5,000 ha of irrigated agriculture

Mosaic Agriculture Option

A *mosaic* irrigation option was explored. This involves the establishment of smaller scale intensive irrigated cattle production systems that can be incorporated into the existing extensive grazing system. Water supply for this type of development is assumed to come from groundwater pumping. The irrigation development assessed in this report is based on the Mowanjum irrigation trial, a stand and graze production model. This production model involves feeding weaned cattle on improved pastures grown under centre pivot irrigation for the purpose of selling a heavier animal to the live export market or to feedlot operations. The scenario we examined involves the development of a 60-hectare centre pivot with weaned cattle grazing a Rhodes Grass pasture.

Large-Scale Irrigation Scheme

A large-scale irrigation scheme similar to the large irrigation proposal from the CSIRO Northern Australia Water Resource Assessment (Taylor, Dawes et al. 2018) (Taylor, Dawes et al. 2018) was also evaluated. This involves large-scale water storage and development of large irrigated areas. Estimates of capital costs, water yields and land development costs were sourced primarily from CSIRO Northern Australia Water Resource Assessment (Taylor, Dawes et al. 2018) including their assumptions of an 870 gigalitre dam development irrigating in excess of 38,000 ha of land on the Margaret River, with an assumed lifespan of 100 years.

4.2 Evaluation Method

The relative economic merits of each of the development scenarios proposed were evaluated using benefit cost analysis. This approach allows for the systematic estimation of the strengths and weaknesses of each investment option by determining if the tangible economic benefits of a given project outweigh the costs. The metric created by this analysis is the benefit cost ratio (BCR). A BCR of greater than 1.0 indicates that the economic benefits derived from the project outweigh the economic costs and vice versa for a BCR of less than 1.0. The larger the BCR is above one, the more profitable it is. Time streams of both the benefits and costs were discounted over the span of the proposed project life. All technical detail documenting assumptions, parameter values, data sources and formulae applied are documented in Appendix 1.

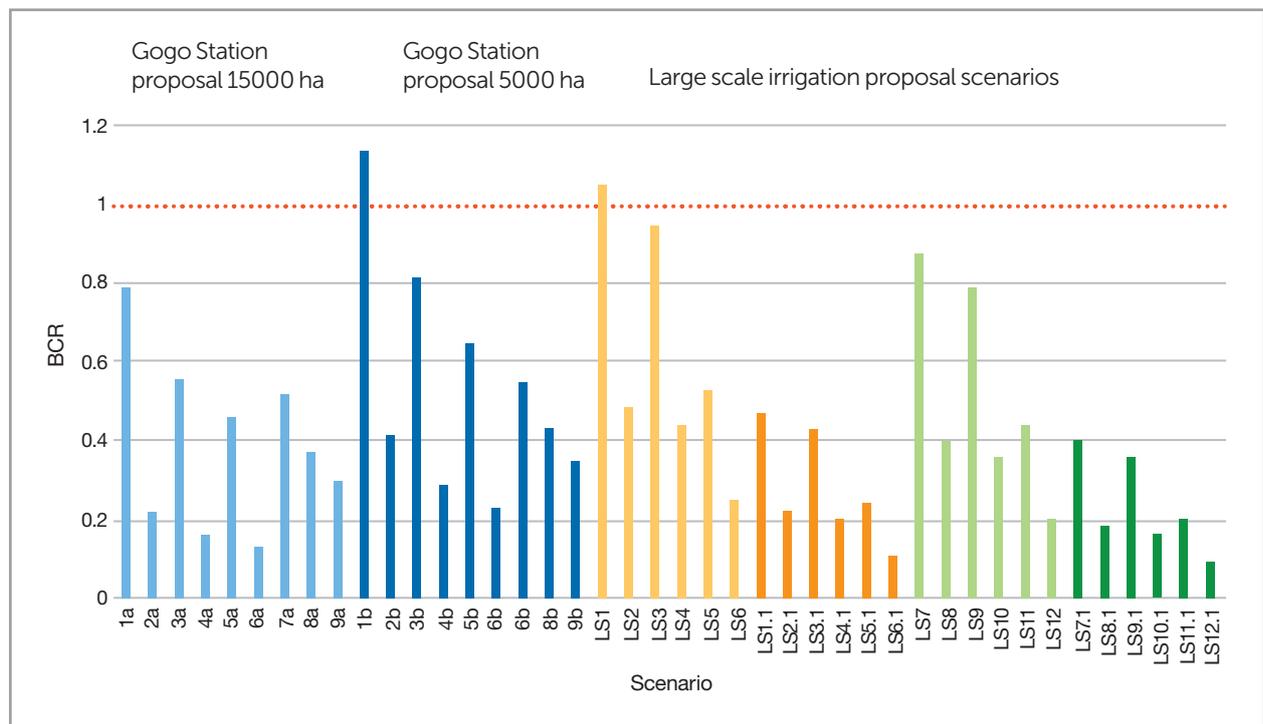
In benefit cost analysis (BCA) for all options, we attempted to use parameters consistent with actual proposals to the best of our ability within the constraints of publicly available data. In addition, to provide a robust view of the likelihood of positive returns, we also assessed net benefit for additional scenarios using additional 'reference class forecasting' based assumptions. Reference class forecasting is the practice of using parameter values consistent with experience from well-documented past similar investments in prospective future investment evaluation.

This is best practice to protect against optimism bias, the systematic human tendency to be optimistic about expected outcomes when faced with uncertainty (Kahneman and Tversky 1977). It is often observed in experts including statisticians, engineers and economists especially in large complex project benefit cost analysis (Ansar, Flyvbjerg et al. 2014). Dam and irrigation development project economics assessments, in particular, have a well-documented history of over-optimistic initial net benefit expectations relative to observed outcomes. One relevant study evaluated of actual versus prior estimates for 98 large dams built in Australia since 1888 (Petheram and McMahon 2012). The study found that on cost overruns across the sample of projects averaged 120%. To correct for this potential, we followed emerging best practice reference class forecasting techniques as, for example, recently applied to hydro-electric investment analysis by (Awojobi and Jenkins 2016). This involves using realism tempered observations from outcomes in similar past projects for key sensitive parameter values driving realised BCA. Details of assumptions used in this sensitivity analysis are fully documented in Appendix 1.

4.3 Irrigation Proposal Benefit Cost Results

Results for all surface water dam irrigation proposals show that only two of the scenarios developed yielded BCR values in excess of 1.0 (Figure 1). This indicates a poor likelihood that irrigation developments in the Martuwarra (Fitzroy River) catchment, such as those outlined in both the Gogo Station development proposal and CSIRO NAWRA studies, would be profitable. Mosaic irrigation provides the most promising opportunity for irrigation development (Figure 2), however, high beef prices are required for this to be profitable.

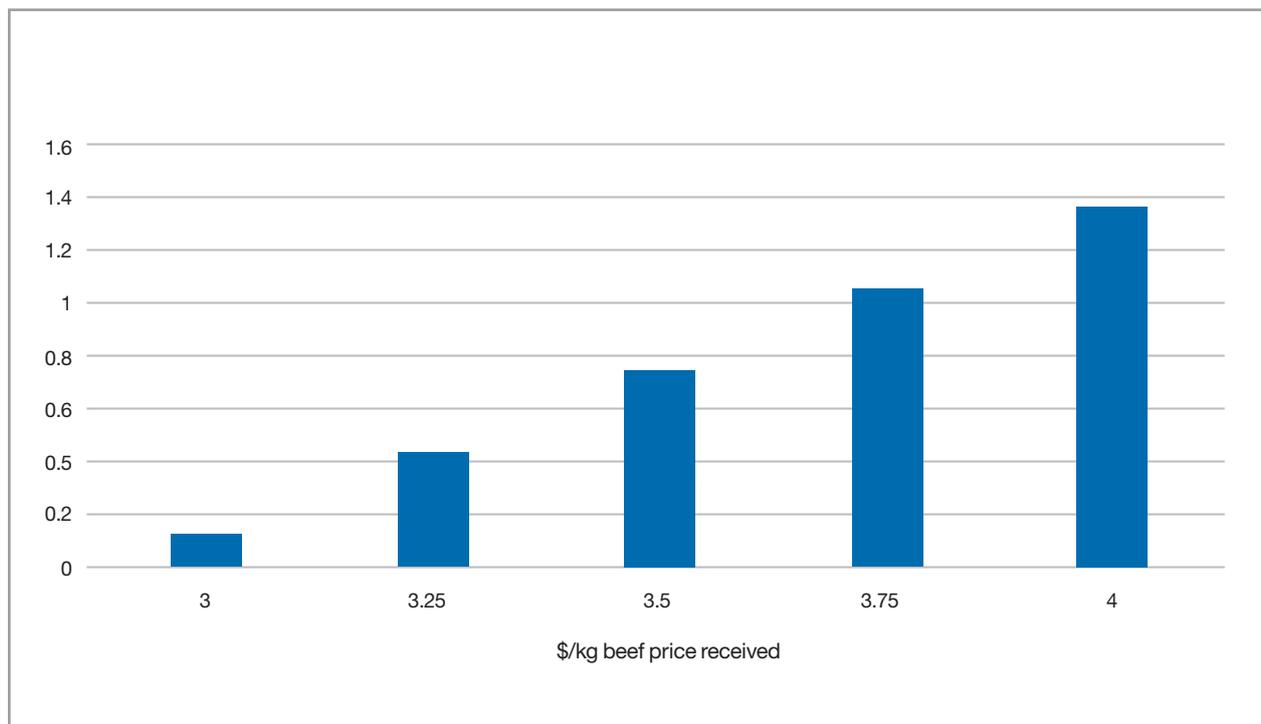
Figure 1: BCR of the Gogo Station and large scale irrigation scheme developments



When looking at the Gogo Station proposal specifically, only under conditions of low development costs and high water yields would the proposal be near profitable. The proposal outlines sorghum as the crop to be grown, however, sorghum produces some of the lowest gross margins of any crop suitable to be grown in the region (Ash, Irvin et al. 2018). A more diverse cropping program including higher value crops such as cotton, sugar and horticultural crops may yield higher returns than sorghum. However, these crops would require the development of specific processing facilities, in the case of cotton and sugar, and expensive cold storage supply chains in the case of high value horticultural crops. The expense of such facilities would require sufficient economies of scale to be achieved to overcome their development costs and in order to overcome the distance of the Martuwurra (Fitzroy River) from major markets in the South and East of Australia, or North to Asia. This is something that has been difficult to achieve to date in the Ord River development, which has witnessed the failure of both the cotton and sugar industries in the past (Ash 2014, Grudnoff and Campbell 2017). The development of an integrated 5,000 head cattle feedlot outlined in the Gogo Station proposal could potentially have a positive BCR. However, the integration of this into the cropping program was not outlined in the proponent's business plan and was not examined in this report. In any case, the amount of grain that could be realistically value added through the feedlot is far below the total production from the full 15,000 ha development. As such, it is likely that the positive effect on the overall BCR from this development from the inclusion of the cattle feedlot would be marginal.

In terms of off-stream water storage and irrigated land development, the scaled back, 50GL development would be closer to economically viable. However, similarly to the full-scale development, the project is only profitable under optimistic assumptions of high water storage yield, high revenue and low development costs. Under any other assumptions, even a scaled back Gogo Station development is unviable according to our results.

Figure 2: Benefit-cost ratio for mosaic agriculture option at varying beef prices



Mosaic agriculture developments that depend on groundwater pumping rather than dam development presents the most likely irrigation option to be economically viable in the Martuwarra catchment (*Figure 2*). The scenario developed was based on the Mowanjum trial and involved early weaning of cattle and faster weight gain. The results of such an enterprise are reliant on pasture utilisation rates and weight gains from improved nutrition. The results indicated that significant economic gains could be made from such a system, however, development costs for pivot infrastructure appear prohibitive in many situations. Examples do exist where these systems are proving more profitable, including Pardoo Station, east of Port Hedland (Maughan 2018). In this instance, the irrigation development provides feed for high value Wagyu cattle for feedlots in the south and has occurred in conjunction with the development of a *premium* beef brand that exports full carcasses to Asia, including to China. To be economic, development of such irrigation projects may need to occur in the context of high value, premium products for well-defined end markets.

The outcome for the large-scale irrigation developments evaluated is highly dependent on the construction costs and water yields from the storage, land utilisation rates and revenues from irrigated agriculture. Our results indicate that only under the most optimistic assumption would such an investment be profitable. However, when considering development costs more in line with what has been experienced in other irrigation developments in the north of Australia (Dent and Ward 2015), our results indicate that such a development would not be profitable. The BCRs for the scenarios we examined ranged between 0.09 and 1.05, with an average BCR of 0.41 across all the scenarios. These results are comparable to other analyses outlined in Grudnoff and Campbell (2017) that estimated a BCR of 0.44 for the Ord River development.

Proposals emerging after our economic analysis suggest cotton as a profitable option more so than sorghum as proposed for Gogo Station. One issue worth noting is that cotton has been widely grown in the Ord and has largely proven unprofitable. A lack of local processing facilities would see any proposal suffer from the same tyranny of distance factors that have plagued other irrigation project in northern Australia. If Gogo were to build facilities, not only would this be an additional cost, but the vertically integrated nature of the business would see the transport costs transferred from the agricultural side of the business to the processing side. Without significant economies of scale to absorb these considerable costs, generally meaning multiple suppliers on which to spread costs, cotton production at Gogo would likely suffer from many of the same issues that made the crop largely unprofitable in the Ord.

4.4 Public Good Social and Environmental Costs

Few, if any, past northern Australian irrigation project benefit cost analyses have factored in the costs of lost social, amenity, or cultural values and capital. Likewise, effects on downstream industries such as fisheries and environmental costs such as carbon sequestration lost when native vegetation is cleared have been mostly ignored. Rigorous consideration of these factors is likely to increase the costs of any irrigation development (Molinari 2016).

A common argument for ignoring such costs in the past has been the dearth of relevant data and methods to assess complex processes leading to cultural and environmental outcomes and value creation. Whilst it is truly an under-researched area, a number of relevant studies from related northern Australian Aboriginal context provide some relevant insights. Here we provide a synopsis of relevant findings from our review. This provides some indicative sense of the potential magnitude of these costs.

4.4.1 Carbon Emissions Costs

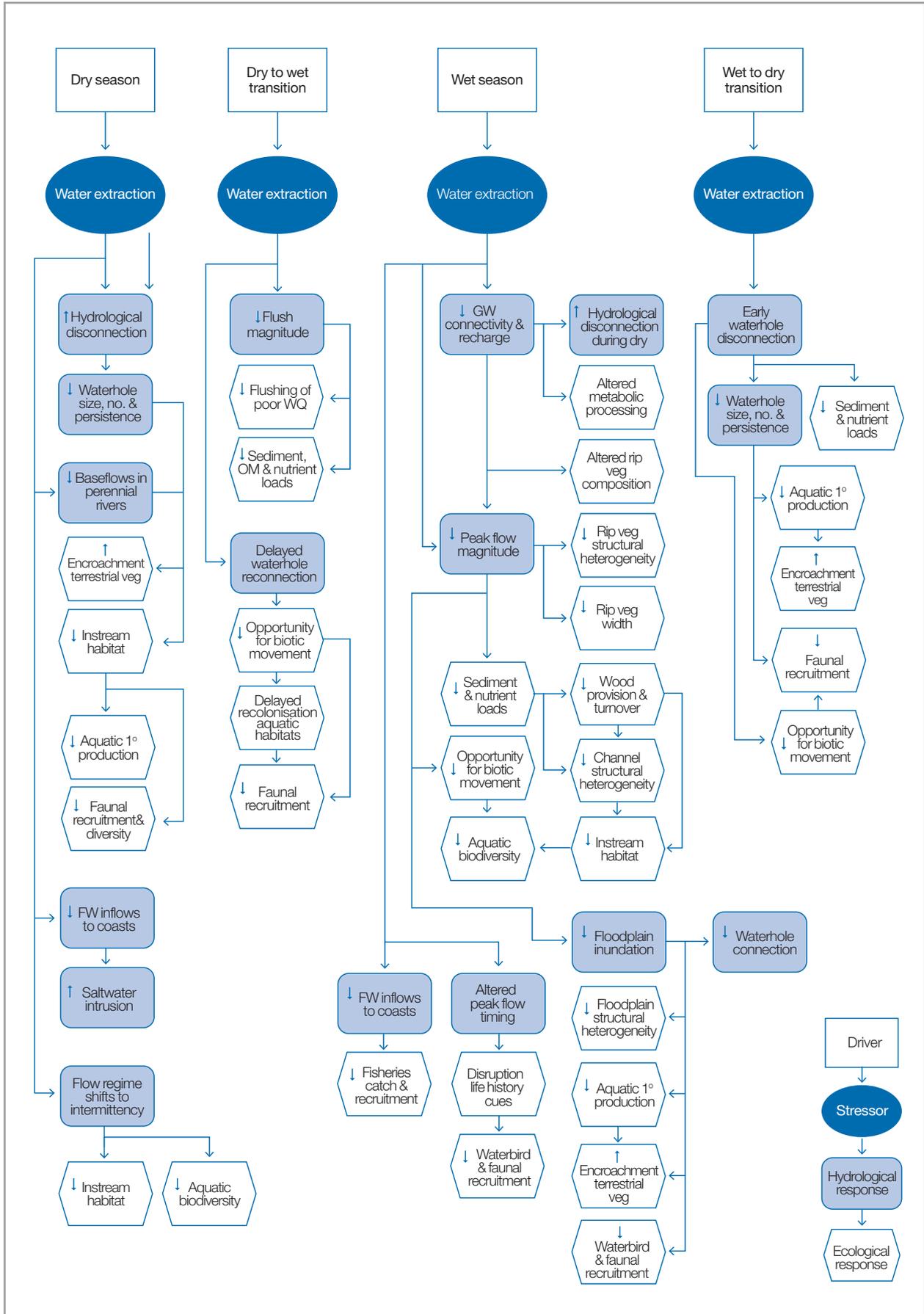
Emissions from land use change account for approximately 10 percent of man-made emissions globally (Le Quéré, Moriarty et al. 2015) and large-scale land use change in the northern savannas of Australia has the potential to add up to 3 percent to Australia's emissions (Bristow, Hutley et al. 2016). The inclusion of the agriculture/land use sector in emissions trading schemes is being discussed globally, most prominently in New Zealand. In addition to being of great importance environmentally, developments involving substantial land use change with large carbon emissions are also increasingly viewed as risks by financial institutions and investors.

Data published by Bristow, Hutley et al. (2016) showed that total emissions from land use change from the predominant savannah ecosystem to agricultural land uses in northern Australia would be in the order of 148 t CO₂-e/ha. If this carbon was required to be offset, at current average Emissions Reduction Fund prices of approximately \$13/t CO₂-e (Evans, 2018), it would add an additional cost to the 15,000 ha development proposal of approximately \$1,900/ha, or \$28.m, accounting for the irrigated land alone. This one costed externality is approximately 15 percent of the entire project's planned investment. Whilst the numbers are only approximate figures and require more careful investigation, they do suggest the potential to create a GHG liability of greater value than the entire value of the proposed project investment. This finding is not inconsistent with other peer reviewed research suggesting that imputing GHG emissions costs significantly erodes economic return to Northern Australian agriculture. For example, one recent study found that imputing the cost of GHG and land degradation halves returns to the livestock industry in Northern Australia (Russell-Smith, Sangha et al. 2018).

4.4.2 Other Natural and Cultural Asset Degradation Costs

The ecological dynamics of river and floodplain ecosystems are to a large extent determined by high variability and low predictability in seasonal flooding and drought (Pettit, Naiman et al. 2017). These aspects of river flow are important in conferring resilience to river systems by enabling a range of biological and physical characteristics to interact with the life history traits of biota and fish (Lake, Bond et al. 2007), (Naiman, Latterell et al. 2008), (Warfe, Pettit et al. 2011). Figure 3 summarises predicted hydrological and ecological responses of rivers and floodplains in northern Australia to small-scale, but cumulative, water development. This highlights the potential for harm from extraction in ways that are inherently complex, and the need for careful assessment before allowing flow reducing water taking.

Figure 3. Hydrological and ecological responses of river and floodplains in northern Australia to small-scale, but cumulative, water development (Warfe et al. 2011)



One important value at risk from Martuwarra irrigation development is Indigenous harvest of aquatic species. The availability of river fish and cherabin species contributes important food supplies to Indigenous communities on the Fitzroy river catchments (Jackson, Finn et al. 2014) and this food source is strongly linked to natural river flow and is likely to be substantially affected by flow alterations that modify habitat availability and species distributions (Jackson, Finn et al. 2012). A study across the Daly, Mitchell and Fitzroy catchments estimates that this wild harvest accounts for up to 25% of the value of food consumed in Indigenous households (Jackson, Finn et al. 2014). Across remote Australia, 72% of Indigenous people over the age of 15 participate in the harvesting of wild resources, and up to an estimated 80% of the protein consumed by Indigenous people in northern Australia is derived from the customary (non-market) sector (Jackson, Finn et al. 2012). Another relevant study estimates that harvested wildlife form a large proportion of the diet in part of the Arnhem Land, with the imputed value of wildlife representative 50% of the total income for some individuals and groups (Altman and Whitehead 2004).

The value of social dimensions of the benefits that the largely ecologically intact country in the Aboriginal estate in northern Australia provides is another value at risk that has been mostly excluded from Northern Australian agricultural and irrigation development benefit cost assessments. Some suggest that it is primarily methodological barriers to the valuation of more complex social goods that Aboriginal people derive from Country that has led to their frequent omission from natural resource management deliberations (Stoeckl, Hicks et al. 2018). One study we identified does provide a quantitative monetary metric estimates of the social benefit of bush preservation in Indigenous ownership (Sangha, Russell-Smith et al. 2017). The study values transferring 180,000 ha Fish River Station from private to Indigenous estate and allowing 100-plus Indigenous people to occasionally access Country mainly for cultural and ceremonial purposes or for hunting, collecting bush food and medicines. Dollar quantification involves imputing value to the time spent on Country using substitute cost (government welfare service) and equivalent cost (foregone wages) metrics. The result is a \$2.2m benefit, in the context of a \$105,000 foregone benefit from the previous beef enterprise and an \$800,000 cost to maintain the station.

The 2017 Fitzroy River Science Statement (Moritz, Dixon et al. 2019) further outlines the numerous significant cultural, archaeological and environmental values of the Martuwarra catchment, noting that:

The ecology and hydrology of the river is shaped by highly variable and unpredictable river flows. Waterholes along the course of the river and its tributaries provide vital refugia for wildlife during the dry season months, including fish, turtles, invertebrates, crocodiles and birds. Many waterholes are fed by groundwater during the dry season in a complex interaction between surface and groundwater. Surface waters then recharge groundwater in the wet season when river flows occur. The magnitude of these interactions is likely to vary significantly from year to year, as the volume of and duration of river flow is highly variable. These interactions between surface water and groundwater will also be highly variable along the length of the river.

The Statement also highlights the importance of freshwater discharge into the marine environment:

High volume freshwater flows from the river into King Sound are critical for both ecological functioning and the long-term sustainability of the pearling, recreational and commercial fishing and tourism industries. These flows act as a pathway for those species that spend part of their life-cycle in both marine and freshwater environments, such as Barramundi, Freshwater Sawfish and Mulletts. Scientific research has consistently identified the importance of wet season flows from northern Australian rivers in determining the productivity of many species of estuarine fish and crustaceans of economic significance.

From this brief review of the literature, it is clear that a range of complex and important values are highly dependent on the unpredictable and complex natural flow regimes in the Martuwarra catchment. We conclude that significant environmental, cultural and Indigenous use externalities exist that we have not assessed for in our benefit cost analysis.

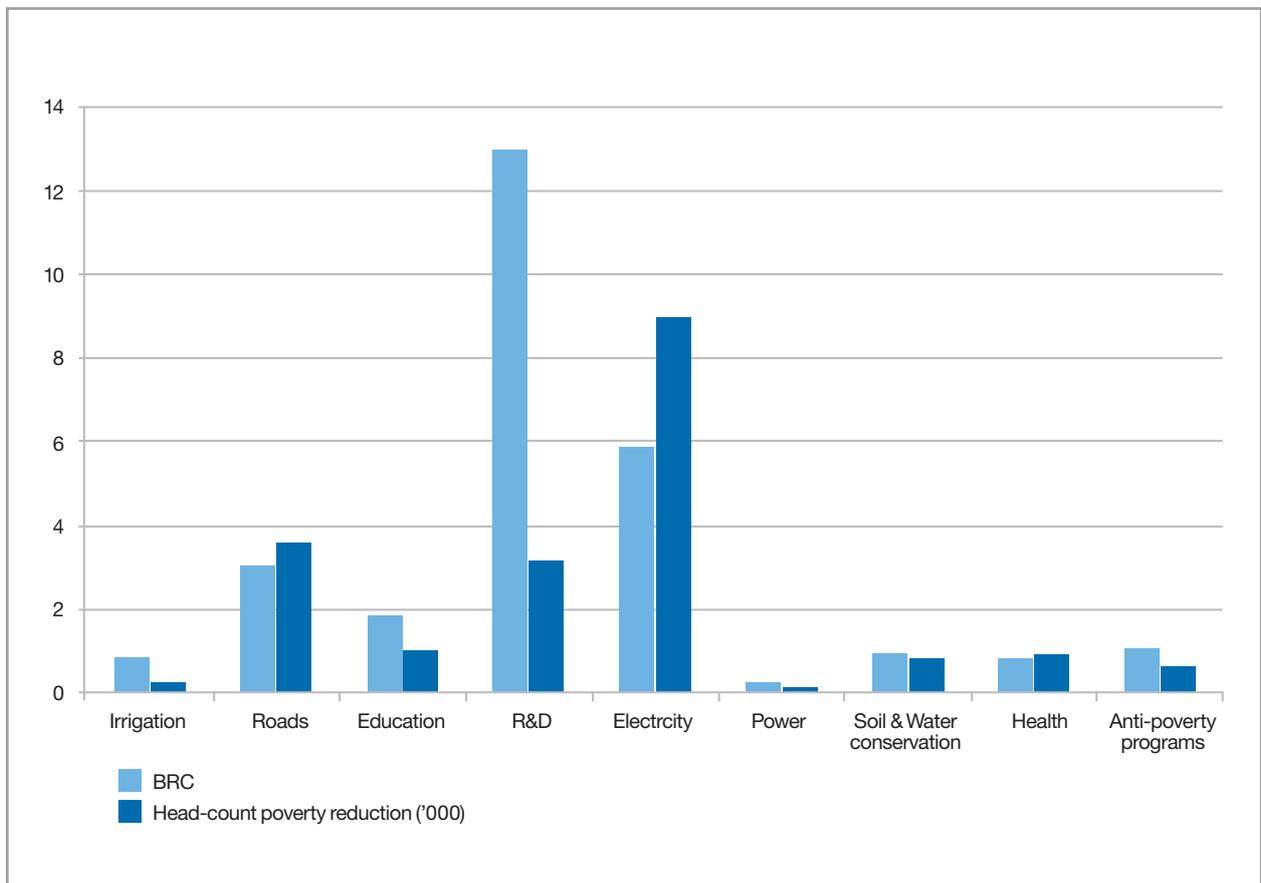
4.5 Job Creation from Irrigation Investment

Despite the intuitive appeal of irrigation project development as a strategy to drive remote northern Australian economic development, history in Australia and elsewhere reveals that long run job creation potential from such investments tends to be limited. For example, the Western Australian auditor general's report on the Ord East Kimberley irrigation development found that despite new expenditures since 2010 of \$529m, the expansion project employed only about 61 people in 2016 (W.A.A.G 2016). Given that the Western Australian Department for Regional Development claims that 20% to 35% of these people were Aboriginal, this suggests that the scheme may have created sustained employment for 12 to 21 local Aboriginal people (W.A.A.G 2016). Similar patterns of initial employment benefits in the building phase but very little sustained employment were found to result from another Northern Australian Water Resources Assessment proposal for irrigation in the Queensland Flinders and Gilbert proposed irrigation development (Wittwer and Banerjee 2015).

Some of the impediments that resulted in very low sustained job creation benefit per dollar invested in the Ord scheme may be more easily surmounted today than they were historically. However, irrigation and dam development are inherently capital and out of region input intensive economic sectors. Like other large infrastructure projects, irrigation and dam developments do create spikes of initial employment and income. For example, in the recent Ord scheme development phase over 200 Aboriginal people were employed and trained (W.A.A.G 2016).

Ultimately, public irrigation investment tends to be less attractive because it has fewer broad spill-over effects that are widely dispersed across other sectors as productivity gains or cost savings compared to many other types of public infrastructure investments. International literature suggests that roads and electrification infrastructure and services investments, like health and education, all create multiples more of regional income and head-count poverty reduction (Fan 2008), (Kandulu and Connor 2017). Similarly, in a more local Murray Darling Basin context, (Wittwer and Dixon 2013) showed that additional spending on essential services instead of spending on water efficiency infrastructure would have created four times as many jobs for each dollar spent.

Figure 4: Comparing benefit cost ratios and poverty head-count reductions from a \$1m investment in various sectors. Source: Kandulu and Connor (2017)



5. Indigenous Economic Development

5.1 Overview of Indigenous Economic Development Literature

A question that naturally arises is what alternative investments might provide better social and economic outcomes for local Aboriginal people and the region. The body of literature on Indigenous economic development provides some useful insights.

One insight is that Indigenous businesses are an important contributor to Australia's economy, contributing between \$2.2b and \$6.6b to the Australian economy which is between 0.4% and 0.6% of national GDP (PwC 2018). Of the top 500 Indigenous businesses, 122 are in Western Australia (Urbis 2014). Many of these businesses are servicing established industries in ways that give Indigenous people greater control over their employment and income (Urbis 2014) including Indigenous-owned pastoral leases. Others, such as those outlined later in this report, are emerging industries that are seeking to capitalize on the significant natural and cultural capital in places such as the Martuwarra catchment. The main categories of enterprise conducted by Aboriginal and Torres Strait Island corporations are health and community services, employment and training, land management, art centres, shops, housing and education (Urbis 2014).

The factors that determine the success of Indigenous enterprises in both the Australian and global context have been the subject of considerable study. One dominant theme throughout the literature is that Indigenous businesses and development programs are more successful when they are led by Indigenous communities, or where Indigenous communities have significant control and input into development (Urbis 2014), (SEC 2017), (Hunt 2013), (McRae-Williams and Guenther 2016). Australia is cited as lagging behind other developed nations such as the United States, Canada and New Zealand where a shift towards a 'nation building' approach based on humanistic economic development theory that fosters self-directed Indigenous development has been more successful than Australian policy approaches (Dianna 2007), (Cornell and Jorgensen 2007) and where there is a comprehensive legal framework or treaty that enshrines certain rights for First People, or gives First People significant levels of control (Hunt 2013). A successful policy environment is one where government policy encourages Indigenous communities to engage in the policy development process (Urbis 2014) and where engagement is built on long-term sustained relationships based on trust, integrity and shared goals. Policy should also enable locally-driven and Indigenous-led responses to regional challenges (Urbis 2014), especially where these are complex challenges (Hunt 2013). There is also a strong emphasis on investing in human capital and governance capacity that has cultural legitimacy (Urbis 2014), (Hunt 2013), (McRae-Williams and Guenther 2016). Enterprises that strengthen and preserve culture have stronger chances of success (Urbis 2014).

A paper published by the CRC for Remote Economic Participation in 2016 (McRae-Williams and Guenther 2016) contended that the human, social, identity, cultural and natural capital that exists in remote and very remote Australia can be a basis of economic development. The paper contends that this is a different and more enabling approach than the dominant discourse that is about remote disadvantage and deficit and policy responses that seek to redress deficit (McRae-Williams and Guenther 2016). A key concept in Indigenous development literature is the importance of the concept of sustainable livelihoods (Greiner, Stanley et al. 2012). (Greiner, Stanley et al. 2012) describes this concept:

The concept of livelihoods encapsulates much more than financial aspects of life. It also considers human, social, natural and physical dimensions as making important contributions at the individual, household and community level. These dimensions are typically classified as 'assets' or 'capital.'

A conceptual framework to guide sustainable livelihoods is proposed that encompasses five pillars: financial assets, social assets, human assets, physical assets and natural assets. (Greiner, Stanley et al. 2012) define these as:

- Natural capital: refers to the stocks and flows of natural resources that support activities that contribute to livelihoods.
- Physical capital: refers to both the infrastructure and tools and equipment used by people in their livelihood activities.
- Financial capital: describes the financial resources (savings, credit, cash, or regular in-flows of money remittances, pensions, royalties, etc.) accessed by people to create livelihoods and that can be used to access other resources.
- Human capital: refers to the skills, knowledge and health embodied by people that contributes to their ability to engage in livelihood activities through labour.
- Social capital: a complex term used by different people to mean different things. The definition used here is that of (Woolcock and Narayan 2000) "social capital refers to the norms and networks that enable people to act collectively."

Growth in these assets, both in terms of quality and control, leads to sustainable development outcomes (Greiner, Stanley et al. 2012).

A number of potential frameworks for facilitating Indigenous economic development have been suggested, and such a framework could be developed in consultation with Martuwurra Traditional Owners for the Martuwurra (Fitzroy River). Two such examples are summarised briefly below.

In 2014, Urbis produced the report for Westpac Group *Enabling Prosperity: Success Factors for Indigenous Economic Development*. This report undertook a comprehensive review of international and Australian literature and case studies and provided five factors that support economic development in Indigenous communities and for Indigenous entrepreneurship as a basis for regional economic development (Urbis 2014). These were:

1. An authorising environment which includes:
 - a) Governance and institutions which are culturally legitimate and sound.
 - b) Government policy and regulation which facilitates development through business development mechanisms such as mentorship, incentives and business incubators; and through embracing a 'nation building' philosophy to encourage self-determination, accountability and entrepreneurship.
2. Human capital including leadership and social infrastructure (in the Indigenous context the role of culture as a resource is particularly important). Developing human capital was considered to be the most important investment and determining factor in success, and a constraining factor where investment was inadequate to the local context.
3. Access to capital and markets (the literature suggests that Indigenous people face more significant barriers than others in gaining access to loans and other financial assets).
4. Access to infrastructure and needs based on location and diversity and not necessarily the 'roads and rail' or mass processing infrastructure that is often the focus of Government infrastructure support for development. Examples could be housing, broadband internet, a national park or an art centre. There are examples of very remote communities that have had substantial economic successes.
5. Geography and agglomeration (including the location and resources available to a community to enable economic development).

A similar study by Synergies Economic Consulting in 2017 looking at the potential for community ownership of power generation made seven recommendations in a development framework focused on a goal of 'self-determined economic prosperity' as a term to encapsulate the multiple facets of an effective economic development strategy (SEC 2017). The framework development drew on international frameworks such as the United Nations Human Development Report (Program 2010) and the British Department for International Development's Sustainable Livelihoods Framework (Development 1996) and a broad review of the Australian and International economic development literature (SEC 2017).

The seven factors required to achieve self-determined economic prosperity were identified as (SEC 2017):

1. Natural capital (e.g. land, forests, minerals, fertile soil, water, etc.).
2. Access to finance and built capital ('built capital' refers to equipment, buildings and infrastructure), noting that often remote Indigenous communities struggle to attract capital and that micro-loans and provision or 'gifting' of built infrastructure can be effective enablers of development.
3. Access to human capital i.e. labour with the satisfactory skills to participate in economic activities, noting that development strategies that aim to empower communities with the means of starting up their own micro-businesses can assist with building entrepreneurial capacity and technical skills among the local workforce, which then spill over to other parts of the local economy.
4. Social capital (shared understanding of values, norms of behavior and mutual trust; networks for cooperation and support).
5. Access to markets: this factor varies according to the type and value of product. For example, remoteness may be an asset for tourism but a limiting factor for other products. The framework identified that because of this inherent complexity, where possible communities are best placed to assess their own comparative advantages and constraints relating to market access.
6. Good governance, organisational structures and legal system.

7. Suitably defined property rights (or similar rules-based institutions) to land, water and built assets, noting that economic development does not necessarily require that rights to resources and assets are vested in private firms, nor is there a necessity to see such rights through a binary lens of ownership or lack of ownership. Rights can be held in common by a community, and property rights can be considered as a bundle of rights such that rights are shared between Government, community-owned entities and/or private individuals or companies.

The creation of an economic development plan for the Martuwarra catchment would benefit from the development of a specific framework that is developed in partnership with Aboriginal organisations. This conversation should be expected to include the consideration of sustainable livelihoods.

Given the research outlined above on preconditions for successful Indigenous economic development, enterprises that are already being run and developed by Aboriginal organisations and individuals are considered more likely to be successful in achieving development outcomes than those developed outside of the region.

5.2 Literature on Indigenous Aspirations for Economic Development in the Martuwarra Catchment

Prior workshops have been held with Aboriginal people in the Kimberley to look at Indigenous aspirations for development. The outcomes of these are consistent with the literature discussed above on the necessary prerequisites for Indigenous economic development. A key theme that resonates with the outcomes of this report is that economic development for Indigenous people should be through a development pathway (Greiner, Stanley et al. 2012), (Hill, Golson et al. 2005). The economic development frame should be oriented at supporting a diversity of enterprises (Hill, Golson et al. 2005) including micro, small and medium Indigenous-led enterprises, rather than a paradigm of government support for major projects (Greiner, Stanley et al. 2012). Also, that Aboriginal livelihoods are closely connected with water and land (Greiner, Stanley et al. 2012), (Hill, Golson et al. 2005). Aboriginal people see the potential to participate in the knowledge economy and are developing business opportunities to do this, but are seeing Government financial and bureaucratic support for economic development directed at corporate entities from outside of the region rather than at local Indigenous-led enterprise (Greiner, Stanley et al. 2012), (Hill, Golson et al. 2005). Consistent with the development literature, the importance of clarifying Aboriginal rights to water and land and land access for enterprises are also highlighted (Greiner, Stanley et al. 2012), (Hill, Golson et al. 2005). The importance of valuing and supporting the cultural economy and Indigenous use of resources is highlighted (Greiner, Stanley et al. 2012), (Hill, Golson et al. 2005), as is the importance of protecting the Martuwarra (Fitzroy River) and basing economic development around this protection (Hill, Golson et al. 2005).

5.3 Indigenous Land and Sea Management Programs

Literature that we reviewed provided several lines of evidence supporting investments in labour and Aboriginal labour-intensive service sector activities to promote development.

One key reason for greater job creation per dollar investment in government and service sectors relative to agriculture, in general, is greater direct employment per dollar (Wittwer and Dixon 2013). Of particular interest for the Kimberley region are Indigenous land and ranger programs, which have large local employment benefit. Furthermore, a high proportion of these wages are being spent directly in regions, generating economic multipliers and secondary employment benefits: 51% of all expenditures for wages with $\frac{3}{4}$ of wages paid to local Aboriginal people (Jarvis, Stoeckl et al. 2018). Similar high flow-on benefits are derived from government investment in the services and government sectors.

One argument against this type of investment is that the dependence on government demand for employment does not create sustained growth when the source of government expenditure is depleted. Interestingly, new evidence is suggesting that this may not be the case. (Jarvis, Stoeckl et al. 2018) show statistical evidence of time-lagged Indigenous entrepreneurial business creation as a function of Indigenous land and sea management expenditures. Notably, Indigenous business numbers growth, and growth in business income, was explained by two and three year lagged Indigenous land and sea management expenditure directed at sectors directly supporting land care activities and other services activities. The authors interpret the results as evidence of self-sustaining growth following on from the initial investments.

There is additional evidence that Indigenous Land and Sea Management Programs create not only public good environmental benefits but also enable the preservation of culture identity and thus offer the opportunity to improve the well-being of Indigenous people substantially (Greiner, Stanley et al. 2012), (Altman and Whitehead 2004). The second critical element in some Indigenous Land and Sea Management Programs is that they are “training to develop an increasingly skilled Indigenous land management workforce and capacity to effectively coordinate work and leverage for mutually beneficial cross-sector partnerships” (Australia 2016). Best examples include strong elements of Indigenous social enterprise (Spencer, Brueckner et al. 2016). Indigenous Land and Sea Management Programs combine the provision of culture and consistency with cultural values in enterprise models and also emphasize the human capacity of development through related educational enterprises. They can be successful because Indigenous entrepreneurs of the community base can understand and appreciate the desire to reconcile economic activity with traditional ways of life (Dana and Light 2011). This provides opportunity for community-based economic activity (Ratten and Dana 2015). In the evaluation of the Nuwul Indigenous social enterprise in remote Arnhem Land, (Spencer, Brueckner et al. 2016) document the provision of significant social welfare services including the provision of 50 community service placements by the Northern Territory Department of correctional services with only four cases of recidivism. Other developments of new related enterprises also emerged in the form of a plant nursery and landscaping service provision for local councils. A result was a growth in income and income diversity, even at a time when the general economy in the region was experiencing contraction from reduced mining demand for employment.

5.4 Indigenous Led Enterprises in the Martuwarra Catchment

There is a lack of comprehensive research into Indigenous-led enterprises when compared to irrigated agriculture. The review below relies on the available academic literature and also the reports, submissions and papers collected from the region. It provides an initial picture of some of the enterprises being undertaken and considered by Martuwarra Traditional Owners from the ‘best available’ data.

Within the shire of Derby-West Kimberley, the major employers are largely government-related services: health, education and training, and public administration. The next biggest employers are agriculture (pastoralism and associated infrastructure), accommodation and food, construction and retail, transport, and general administration (ABS).

Martuwarra Traditional Owners and Native Title holders are undertaking a range of enterprises in the Martuwarra catchment. These include participation in government services, education, pastoral, retail and construction sectors. This report, however, focusses on enterprises creating products beyond the traditional pastoral and services base for the Martuwarra catchment economy that target external markets as a mechanism for growing the local economy and increasing opportunities for growth and workforce participation.

A common theme emerges across these industries. In each, there is an abundance of natural and cultural capital and a large potential global and/or domestic market. However, the potential of these industries is being constrained by under-investment in governance, human capital, supply chains development and product marketing.

Table 1 gives an overview of some of the enterprises that are being pursued by Martuwarra Traditional Owners, and what information could be found on the market opportunity, jobs potential and requirements for improving or developing supply chains to grow these opportunities. This list is not comprehensive, and further engagement with Martuwarra Traditional Owners is recommended to inform development plans for the Martuwarra catchment. Further detail on these enterprises is included in Appendix 2.

Table 1: Summary of Enterprises being pursued by Martuwarra Traditional Owners

Enterprise	Market Opportunity	Jobs potential	Supply Chain Development
Carbon Farming	Market size is sensitive to Government policy. The opportunity in the Fitzroy Catchment will likely be highly dependent on carbon price and the availability of land with approved vegetation types.	The savanna burning method is most applicable to the northern half of the Martuwarra catchment under the 600-1000mm rainfall methodology. This is a labor-intensive methodology. Most funds raised are directly invested into Aboriginal employment, PBCs and improving fire management. The savanna burning method creates 12 direct jobs/\$m of revenue (RepuTex 2018).	Government consultation with the Indigenous carbon industry, Kimberley Land Council, Martuwarra Fitzroy River Council and PBCs. Clarity on policy. Clarity on Native Title rights relating to carbon. Consideration of targeted capacity building investments. Building the evidence base for a premium price for Indigenous carbon based on ecological, social and cultural co-benefits.
Bush Foods	The global functional foods market is worth US \$130b (DNACRC 2018). Kakadu Plum in Australia is currently worth \$10m (DNACRC 2018) - \$14m (PwC 2017). Total bush food production is difficult to estimate. The best available estimate is between \$15-\$25m p.a. across Australia (Clarke 2012).	It is estimated that between 500-1000 people were directly employed across remote Australia in 2010 (Clarke 2012). Half of these people were living in remote communities.	Continued investment is needed in capacity building and resolving supply issues for existing Kakadu Plum (Gubinge) industry. Policy mechanisms for the protection of intellectual property and Aboriginal businesses. Investment in research into product development in partnership with Martuwarra Traditional Owners. Engage with Traditional Owners (PBCs, Martuwarra Council, Aboriginal businesses) to discuss support and growth requirements.
Tourism	In 2017, 10,000 international and 93,000 domestic tourists visited the Derby-West Kimberley local Government area. Based on average stay and average spend, this equates to approximately \$67m in direct expenditure by tourists (TRA 2016). Using total visitor statistics for the Kimberley (TRA 2016), this equates to a total spend of \$608m across the Kimberley. Tourists in Western Australia are estimated to spend \$15.4 b per annum in Western Australia.	There are 67 tourism businesses in the shire of Derby-West Kimberley. 7 employ 5 to 19 employees, and 10 more than 20 employees (TRA 2017). There are 56 Aboriginal tourism businesses in the Kimberley within the membership of the Western Australian Indigenous Tourism Operators Council (pers comm, WAITOC). Aboriginal tourism is estimated to account for 339 full time jobs across Western Australia and approximately 97-130 in the Kimberley (pers comm, WAITOC). WAITOC members operate two 'camping with custodian' tours in the Martuwarra catchment, and 12 camping and accommodation businesses across the Kimberley (WAITOC 2019). Members also operate more than 30 tours and experiences, with 12 in the broader Martuwarra catchment (WAITOC 2019).	Increased investment in successful product development, industry development and marketing strategies for Aboriginal tourism. Marketing of Martuwarra catchment attractions. Investment in partnerships with Aboriginal Native Title organisations to develop strategic plans and coordinate human capacity/workforce development.

Table 1: Summary of Enterprises being pursued by Martuwarra Traditional Owners (continued)

Enterprise	Market Opportunity	Jobs potential	Supply Chain Development
Traditional Medicine	<p>Global traditional and natural medicine market is worth US\$83b (DNACRC 2018).</p> <p>Within 3-5 years this emerging industry is expected to be worth \$2m p.a. in Australia, and within 5-10 years \$20m p.a. (DNACRC 2018).</p>	<p>Information was not available. It is assumed that the employment profile will be similar to bush foods, with a range of opportunities including highly technical jobs, management roles, cultural advisors, and opportunities for full time or casual labor in the harvesting of products in remote areas.</p>	<p>Investment into research and product and business development in partnership with Martuwarra Traditional Owners.</p> <p>Policy mechanisms for protection of intellectual property.</p>
Education & Science Partnerships	<p>Partnerships in science and education can be drivers of capacity development, innovation and growth.</p> <p>A growing trend is Indigenous rangers forming partnerships with research organisations.</p> <p>Yiramalay school is an example where a partnership between Traditional Owners has developed a studio school that educates 40 Aboriginal people alongside providing cross cultural education experiences for 84 visiting students from Wesley in Melbourne (Drennan 2015).</p> <p>The unique nature of the school allows it to raise funds from both governments and private philanthropy (Drennan 2015).</p> <p>The school has high retention and graduation rates (Drennan 2015).</p>	<p>The school provides direct employment to teachers, administration and service staff (Drennan 2015).</p>	<p>Further research to better define the opportunities and current partnerships and their value and jobs potential.</p>
Arts and Culture	<p>The size of the global arts market is estimated at \$62b. Auctions of art are estimated at \$31b of that market. Australia sells approximately \$186m of art into auctions. Of these sales, approximately \$8.6m is Aboriginal and Torres Strait Islander Art – this amounted to 60% of all Aboriginal art sales between 1997 and 2007. More recent statistics have not been found (Acker 2016).</p> <p>In 2007 the total Aboriginal Art industry in Australia was estimated to be worth between \$150-250m annually (Acker 2016).</p> <p>The average income from creative activities for Aboriginal artists in the Kimberley has been estimated at \$8.1k for visual artists and \$9.5k for performing artists. Total average income for artists is \$27.8k (Throsby 2016).</p>	<p>There are an estimated 2.5 to 3.1 thousand creative artists in the Kimberley (Throsby 2016).</p>	<p>Work with the Martuwarra Council, PBCs and art centres to support and expand art centres and develop international and domestic markets.</p> <p>Consider synergies between the arts and tourism markets.</p>

Key features of the enterprises summarised above that make them attractive as part of an economy built around the protection of the Martuwarra (Fitzroy River) are:

- These industries are already largely Indigenous owned and being developed within the region and are also reliant on traditional knowledge. These factors mean that Aboriginal people have a comparative advantage in these industries when compared with industries that come from outside of the region.
- These industries are labour-intensive and accessible to a low skilled casual workforce seeking to build sustainable livelihoods on Country with the flexibility to meet cultural obligations. A large proportion of revenue is directly invested back into jobs on Country for people who are likely to stay in the region long term and thus build regional wealth over time.
- In addition to a labour-intensive workforce, they also necessitate a smaller number of highly skilled and professional science, research and management positions. In this regard, they have similarities to the successful Indigenous Ranger program whereby there are entry-level (or long term) lower skilled positions and also the opportunity to upskill to more professional roles, or for educated people to return to jobs on Country.
- Most of these industries are reliant on continuing cultural practices and intergenerational transfer of knowledge and thus generate significant cultural and social benefits.
- These industries have a small impact on the environment and are not water intensive. In the case of carbon farming and savanna enhancement for bush foods or traditional medicines they actively work to rehabilitate Country.

5.5 Comparison of Government R&D Programs for Irrigation and Indigenous Enterprise

A number of high-profile government investments in research and development to support the beef cattle and irrigation industries were readily identified. These include the Western Australian Government's Northern Beef Futures program (\$15m) (Development 2017), and Water for Food program (\$15.5m) (Davies and Redman 2014), (Davies and Redman 2015), and a \$1.88m investment into the Commonwealth CRC Developing Sustainable Cropping Systems for Cotton Grains and Fodder Project. The Commonwealth has also invested an estimated \$5m in the Martuwarra (Fitzroy River) catchment through the \$15m Northern Australia Water Resources Assessment (Canavan and Andrews 2016). However, no evidence was found of substantial State Government investment in similar research and development initiatives for Indigenous-led industry in the Martuwarra catchment. Minimal investment from the Commonwealth was found, with the only research identified being an investment of less than \$1m of funding from the Developing Northern Australia CRC to work on pan-northern studies into bush foods and traditional medicines that have study sites in the Martuwarra (Fitzroy River) area.

6. Conclusion and Recommendations

This report evaluated the economics of irrigation developments similar to options that have been proposed recently for Martuwarra (Fitzroy River). We find that absent multiple optimistic assumptions, public investment in irrigation in the region is likely to provide little benefit relative to cost. The exception may be that some private irrigators may find relatively small groundwater-fed centre pivot irrigation profitable to provide forage in cattle operations when high-quality product can be marketed into high-value niche markets. The net benefits are likely to be much less or even negative, with accounting for additional costs that have not commonly been accounted for in past benefit cost analysis related to environmental public good externalities in the loss of natural and cultural capital providing multiple valuable ecosystem services both to local Indigenous people and others. We suggest that efforts to realise value from preserving the river basin main channel, tributaries and associated wetlands from major diversion and preserving the natural and cultural capital it currently provides has the potential to catalyse local Aboriginal and regional economic development, if augmented with local investment in Indigenous land and water management ranger programs and related Indigenous social enterprise models.

We specifically recommend:

1. The Western Australian Government recognize that the most prospective driver of long-term economic growth and increased engagement of local people in the economy of the Martuwarra catchment is not in the current pastoral and services base or agriculture. Best job and wealth creation prospects are from connecting the natural and cultural capital of the Martuwarra catchment with domestic and international markets for a broad set of services; rather than in supporting the production of bulk commodities.
2. The Western Australian Government, Martuwarra Traditional Owners and Aboriginal Organisations should consider forming a long-term partnership based on mutually agreed development goals and philosophies. There is an opportunity to implement an economic development plan based on the human capital, governance and supply chains needed to realise the potential of Aboriginal-led enterprises in the catchment; including direct investment in job creation.
3. The Western Australian Government and Traditional Owners should co-design a research program to better define the current state of Aboriginal economic enterprise in the Martuwarra catchment. This can resolve key knowledge gaps and develop the data base to allow for the proper assessment of externalities in benefit cost analysis for future proposed developments that might impact on the natural and cultural values.
4. To ensure the protection of the natural and cultural capital of the Martuwarra catchment it is essential to limit water allocations to groundwater sources that are not connected to the river channels or wetlands; and to ensure that any allocations are incremental and limited in scale.
5. Regional development can be further facilitated by reviewing current and creating new policies to ensure the availability of financial capital and land access for Aboriginal enterprises.
6. Public investment in public good environmental management.
7. Link conservation initiatives within and outside of proposed national parks with direct investment in job creation in natural and cultural resource management; and develop partnerships with Traditional Owners and Aboriginal businesses to maximise the opportunities to grow human and social capital and governance capacity in this context.
8. Combine investments in Aboriginal social enterprise models with investments in effective leadership and skills development, and successful Aboriginal social entrepreneur mentoring.
9. Incorporate Aboriginal knowledge and modern science in environmental research to support regional land and water, and economic development plans.

7. Appendices

Appendices are available on request.

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