

# MAINTAINING SAFE NAVIGATION OF KEY RIVER & PORT ENTRANCES IN NSW

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**ABSTRACT:** Trained entrances of coastal rivers can significantly alter the hydraulic behaviour and sedimentation processes both within the estuaries and along the adjacent coastlines (NSW Government, 1990). As a consequence, accretion of the submerged land within and near river entrances can affect tidal flow, water quality and navigation.

Submerged land, defined by the area between mean high water mark and the State's territorial limit which extends 3 nautical miles (5.5 km) out to sea, is generally Crown land. The Department of Lands is responsible for submerged Crown land which includes most coastal estuaries, many large riverbeds and some coastal wetlands.

The Department of Lands is also responsible, under the NSW Government's Minor Ports and River Entrance Programs, for the management and maintenance of important coastal infrastructure (i.e. breakwaters, training walls and minor ports) located on Crown Land.

Dredging of river entrances has historically been undertaken by government to maintain safe navigation for the transportation of people and produce along our coastal waterways and for local commercial fishing fleets operating out of small regional fishing ports.

However, over the last decade, population growth in coastal areas, increased ownership of recreational boats and a shift in the commercial boating sector from fishing to tourism and adventure related activities has placed an unprecedented demand on the use of our coastal waterways. These and other issues have created new challenges for river and port entrance managers.

For the dredging of entrances to trained rivers and minor ports the Department of Lands is coordinating a strategic approach that is merit based to ensure any available funds are applied in a manner to achieve multiple outcomes for the benefit of all people of NSW. This paper discusses the main aspects of the management approach adopted by the Department of Lands.

## Introduction

For the dredging of river and port entrances the Department of Lands (Lands) has adopted a management approach that includes a merit based assessment to ensure any available funds are applied in a strategic manner to achieve multiple outcomes for the benefit of all people of NSW. This paper discusses the main aspects of the management approach adopted by Lands, including consideration of case studies.

## Background

Historically, Government has undertaken dredging of navigation channels in coastal waterways to facilitate the transportation of people and produce between regional centres, cities and overseas. From the early ninetieth century considerable public funds have been expended on river entrance infrastructure and dredging to facilitate sea transportation (Coltheart, 1997). This remains the case in the four commercial ports of Newcastle, Sydney, Port Botany and Port Kembla where respective port authorities maintain port infrastructure and when necessary undertake navigation dredging for commercial vessels.

By the mid twentieth century, transportation of people and produce by sea had all shifted to more reliable and faster rail transportation (Clark, 2001). Commercial fishing gradually replaced trade, and albeit on a smaller scale, Government effort was directed to small fishing port development. More recently, use of the small fishing ports and river entrances has shifted from commercial fishing to recreational and tourist related activities. The trend in the growth of recreational boat owners and coastal tourism is not expected to slow.

The NSW Government has a long history of involvement with the dredging of the State's coastal waterways to support the ongoing use of existing maritime infrastructure which has been developed through the expenditure of substantial public funds. Dredging of river entrances and small ports has historically been a component of the River Entrances Program, which is currently administered by Lands. It should be noted that dredging of coastal waterways has also been undertaken by other State Government Agencies, State Owned Corporations and local Government Authorities under other funding arrangements and by private operators for commercial benefits.

Outside the four commercial ports the contemporary issue of responsibility for dredging navigation channels has become less clear. The historical precedent established when river access was fundamental to the State's economic growth created an ongoing expectation of government responsibility. That expectation is now being clearly enunciated from recreational boat and tourism user groups.

The cost of river entrance dredging is high and any benefits are often short lived due to the dynamic nature of the estuary/coastal interface. The cost to sustain constant river entrance depths can out weigh the social, environmental and economic benefits provided by dredging.

Coordination of dredging activities to date has largely been responsive and ad-hoc with limited consideration given to the benefits or costs and the availability of funding. Without a merit based process, dredging programs can be overly responsive to calls and pressure from the community and/or user groups.

The Department of Lands has been given the responsibility for the coordination of dredging in tidal waterways. The challenge for Lands has been to develop a management approach for dredging of entrances to trained rivers and minor ports that is strategic, consistent and reflects key social, environmental and economic drivers.

## **Dredging and Crown Land**

Department of Lands is responsible for all Crown Land in NSW, under the Crown Land Act 1989. Crown Land also includes the bed of the State's waterways. The State's submerged land is defined by the area between mean high water mark and the State's territorial limit which extends 3 nautical miles (5.5 km) out to sea and includes the ocean floor, most coastal estuaries, many large riverbeds and some coastal wetlands.

Under the Crown Land Act, approval of the Department of Lands is required where material is proposed to be dredged from or placed on Crown Land. Approval by Lands includes an application for a Crown Lands licence which must be supported by an environmental impact assessment report. Each licence application is assessed individually and takes into account government policies, land assessment, native title and development consent. Licences issued for the extraction of materials for commercial purposes also attract royalty payments on the material in addition to an annual rent of the area of land.

## **Types of dredging that require approval from Department of Lands**

Dredging is undertaken in tidal waterways for a range of purposes by State government agencies, local authorities and by private operators. Examples of dredging undertaken in NSW that requires the approval of the Department of Lands includes the following:

### ***Enhanced tidal flushing to improve water quality and reduced flood liability***

The effect of urban expansion, clearing of vegetation and changed landuses on the quality of receiving waters is well documented. In some NSW estuaries and small coastal lakes and lagoons, known as Intermittently Closed and Open Lakes and Lagoons (ICOLL's) deterioration in water quality has led to calls from local communities for dredging in an attempt to improve tidal flushing and water quality. In the case of ICOLL's, this usually involves the artificial opening of partially or fully closed entrances.

The situation is exacerbated where development has been allowed to encroach around foreshores of ICOLL's without adequate consideration of flood levels. Partially or closed entrances can restrict catchment and storm inflows and trigger demands from local communities for the opening of the entrance to lower water levels.

This type of dredging is usually identified and supported by an Estuary Management Plan and undertaken by local government authorities. Approval from Lands is required where material is proposed to be dredged from or placed on Crown Land. Approval from other State and local authorities may also be required.

### ***Extraction of material for construction and/or fill***

The use of dredged material for construction activities and the raising of low lying land adjacent to rivers and estuaries occurs largely because suitable material is readily accessible and economical. This type of dredging is usually initiated and undertaken by the private sector under the provisions of relevant legislation. Approval from Lands is required where material is proposed to be dredged from or placed on Crown Land. Approval from other State and local authorities may also be required. If approved by Lands, the payment of royalties on the material in addition to an annual rent of the area of land may be required.

### ***Maintaining boating access to moorings, tidal creeks, oyster leases and private property in estuaries and coastal lakes***

Maintaining boating access to public/private jetties, wharves, swing moorings, boat ramps, aquaculture leases and around the foreshores of estuaries and coastal lakes is an important issue for recreational and charter boat owners. In most cases, accretion around estuarine foreshores is the result of sediment runoff from the catchment. Accelerated infilling of our waterways has long been identified as a major catchment management issue.

Dredging of this nature usually involves the removal of small quantities of sediment using small dredging plant. This type of dredging can be complicated by environmental constraints such as the presence of seagrass beds, threatened fauna species, acid sulfate soils and contaminants, poor water quality, generation of odours and acceptable methods and locations for the placement of the dredge material. These factors alone can often make this type of dredging socially and economically unviable.

This type of dredging is usually initiated and undertaken by private owners or lessees or by local authorities under the provisions of relevant legislation. Approval from Lands is required where material is proposed to be dredged from or placed on Crown Land. Approval from other State and local authorities may also be required.

## ***Extraction of material for environmental and coastal protection works***

Recession of beach and estuarine foreshores has the potential to cause inundation of the areas located behind beach and foredune systems and estuarine foreshores. In severe cases, public and private property and environmentally, scientific and culturally sensitive areas such as coastal lagoons, wetlands, mangrove and saltmarsh communities can be severely damaged.

Extraction of suitable material by dredging from and near river entrances is a strategy employed to ameliorate the adverse impacts of accelerated foreshore recession and restore the foreshore alignment. Dredging of this nature has been undertaken at Jimmy's Beach (Hawks Nest) and Towra Beach (Botany Bay).

This type of dredging is usually undertaken by State and local government authorities and the approval from Lands is required where material is proposed to be dredged from or placed on Crown Land. Approval from other State and local authorities may also be required.

## **River Entrances Program**

The NSW Government's construction and management of trained river entrances and port facilities dates back to the mid 1800's with the establishment of the Department of Public Works' Harbours and River Branch. Over the ensuing 170 years, the Branch constructed, under various government funded programs, river training works in over 21 estuaries, over 29 port facilities and a range of other maritime facilities along the coast of NSW. In addition, the Branch operated a 'battalion of dredges' which were kept busy along the coast to ensure that safe access to the river entrances was maintained (Coltheart, 1997).

While the scale of river and port works has changed over time, the Government has retained a strong commitment to ensuring key river entrances and small ports are properly maintained.

Dredging of the entrances to trained rivers and minor ports has historically been a component of the River Entrances Program, which is currently administered by the Department of Lands. The focus of this program is the management and maintenance of important coastal infrastructure such as breakwaters and training walls located on Crown Land. Maintaining access to important State maritime infrastructure is a key component of this program and is a desired outcome of the NSW State Plan. The River Entrances Program is the main focus of this paper.

## ***Maintenance dredging under the River Entrances Program for improved navigation and access for vessels at river entrances and to minor ports***

River entrances are important features found along the NSW coast. River entrances are dynamic in nature due largely to the influence of opposing forces that converge when the river meets the sea. Put simply, prevailing coastal forces (i.e. incoming tide and the littoral drift of sand that is constantly pushed northward along the coast by the predominant southeast swell) push sand into river entrances while river and ebb tide flows push some of the sand back out to sea. The confluence of coastal and river flows contribute to the formation of entrance bars and accretion of navigation channels.

It should be noted that the construction of breakwaters and training walls in river entrances does not eliminate the formation of entrance bars and accretion of sand in navigation channels and periodic dredging is often required. Examples where dredging of trained river entrances has occurred along the NSW coast on a regular basis includes the Tweed and Clarence Rivers.

The entrance to and the bed of minor ports can also be subject to coastal and estuarine processes and from time to time have problems with reduced navigational and berthing depths. Maintenance dredging in and around the minor ports is usually smaller scale and can be limited in the type of dredge plant which can be utilised.

Maintenance dredging of marine sediments that have accumulated in the entrances to trained rivers and minor ports is primarily undertaken by State government authorities and in particular the Department of Lands.

### ***Dredging of river entrances by Department of Lands***

Under the River Entrances and Minor Ports Programs, the Department of Lands maintains 21 river entrances and 25 minor ports along the NSW coast. The Crown maritime assets along the NSW coast are worth in the order of \$2 billion. As previously stated, access to these maritime facilities is considered vital for regional communities.

#### *The need for maintenance dredging*

Due to the dynamic nature of river entrances, changes in navigable depths are inevitable. The Department of Lands utilises a number of methods to monitor the accumulation of marine sediments in the entrances to trained rivers and minor ports. Methods include high resolution aerial photography, site inspections, hydrographic surveys and consultation with other Government authorities such as the NSW Maritime and local waterway users such as commercial fishermen.

The need for maintenance dredging is also brought to the attention of Lands by representations from waterway users who often enlist support from stakeholder groups such as the Boating Industry Association, Boat Owners Association and Commercial Fishermen's Cooperatives, from representations to members of State Parliament and State Ministers and from local government.

Where significant changes in navigable depths are identified or where waterway user concerns are considered justified Department of Lands will undertake a hydrographic survey of the waterway. The hydrographic survey is a useful tool employed to measure river bed heights, compared measured depths against design channel depths (i.e. safe navigable depths) and to quantify river bed height changes over time.

#### *Planning for maintenance dredging*

Planning for a dredging campaign by the Department of Lands is undertaken in accordance with the provisions of State Environmental Planning Policy (SEPP) No. 35 - Maintenance Dredging of Tidal Waterways. SEPP No.35 treats maintenance dredging as an activity under Part V of the Environmental Planning & Assessment Act 1979 (EP&A Act).

DUAP (1993) defines maintenance dredging as the removal of silt, sand or other material which has been deposited in a tidal waterway, to enable the function of the waterway to continue or resume. A tidal waterway is defined as a channel or passage within a body of water where the tide ebbs and flows and where there sufficient width and depth for tidal flow or travel/transport by safe navigation route.

DUAP (1993) states the intent of SEPP No.35 is to enable a waterway to continue to function as a waterway or to resume that function if the function has ceased because of siltation or other cause. SEPP No.35 is not intended for development of new waterways or extension of existing waterways. Dredging for aesthetic reasons, commercial or other reason not connected with the functioning or navigability of the waterway should be assessed under existing planning controls.

Under SEPP No.35 the Department of Lands has an obligation to consider the likely environmental impacts of the activity and to consider the appropriate level of environmental assessment that is required prior to approving the activity. If the anticipated environmental impacts are assessed as *“likely to significantly affect the environment”* then an environmental impact statement (EIS) must be prepared and exhibited before any approval is given. In most instances, the Department of Lands prepares a “Review of Environmental Factors”.

In addition, there is an obligation to identify and contact all relevant government authorities and to take into account any requirements, including any statutory approvals, permits or licenses that the authority’s deems necessary before maintenance dredging can occur.

As part of planning for dredging, the Department of Lands also consults those user groups that have a significant stake in use of the waterway and/or may be affected by the proposed activity. For example, it is important to plan the timing of dredging operations such that they will not interfere with seasonal activities undertaken by commercial fishers in estuaries and adjacent coastal waters.

#### *Cost of maintenance dredging*

The costs associated with dredging include pre-dredge planning and investigations, the dredging activity, project management and post-dredge monitoring. The cost of dredging is influenced by the following four main factors:

- Longevity of dredging, which provides an indication of the frequency of re-establishment of the entrance bar and/or channel accretion and hence the need for repeat dredging;
- Practicality of dredging, which takes into account the location and conditions of the site and the need for specialised dredging equipment;
- Severity of shoaling, quantities and type of material to be moved; and
- Environmental sensitivity, which gives an indication of the level of environmental safeguards which may be required.

The relative importance of these factors can for example be influenced by issues involving approval(s) from Government authorities such as restrictions that may apply to dredging in a Marine Park or in areas where seagrass beds are present. Other influences include options for placement of the dredged material, availability of suitable dredge plant and the rate of shoaling which may be influenced by climatic conditions since previous dredging campaigns.

Based on the experience of the Department of Lands, the estimated cost for dredging marine sediments in entrances to trained rivers and minor ports is shown in Table 1. The estimated figures include investigation and design costs i.e. pre and post dredge surveys, environmental assessments and monitoring and project management.

**Table 1: Estimated cost of dredging**

<b>Category</b>	<b>Quantity</b>	<b>Estimated Cost</b>
Major Dredging	60,000 cubic metres	\$600,000
Medium Dredging	30,000 cubic metres	\$400,000
Minor Dredging	20,000 cubic metres	\$300,000

Historically, the NSW Government has met the full cost of dredging at river entrances and ports to facilitate sea transportation and safe access for commercial fishers. However, with the decline in the reliance on the transportation of people and goods by sea and recent shifts from commercial fishing to recreational and tourist related activities, full funding of dredging in river entrances and minor ports by the Government requires careful consideration and detailed benefit/cost evaluations based on environmental, social and economic factors.

### **Development of a management approach for maintenance dredging**

Until recently, there was no accepted basis for prioritising requests for dredging or a documented methodology to support an assessment of the merits for dredging river entrances. Consequently, given the historical context and the lack of methodology, there has been an expectation that all waterways will be dredged with the full cost met by the State Government.

By comparison, funding assistance under similar government funding programs for eligible projects are merit based and provided on a cost share basis of 50/50 between State and local Government. Joint responsibility for funding helps to ensure that projects are realistic and soundly based.

In February 2007, the Minister for Lands, the Hon Tony Kelly, announced a strategy for assessing priorities for dredging in river and port entrances, with a view to ensuring that limited resources were appropriately allocated.

The management approach adopted by the Department of Lands has been developed to ensure any available funds are applied in a strategic manner to achieve multiple outcomes for the benefit of all people of NSW. Lands will consider dredging under the River Entrances Program where boating access is likely to be influenced by the accumulation of marine sands within the entrances to trained rivers and minor ports.

The management approach adopted by Lands also includes a prioritisation process which will be applied to the 39 trained river entrances and ports located along the NSW coast as the need for dredging is raised.

The factors that will influence Lands consideration of dredging are largely based on the strength of identified environmental, social and economic benefits and where it is practical to undertake dredging. More specifically, dredging will be considered at those entrances and ports where the following characteristics are represented:

- have existing river training structures (i.e. breakwaters and training walls) and port infrastructure (i.e. training walls, revetments, wharfs, jetties, slipway and services);
- have a high boating usage (i.e. river/port is utilised by a high number of commercial fishing and charter vessels and recreational boats);
- are centred around areas with a high local population, particularly growth areas;
- are not located within close proximity to other entrances and ports with similar characteristics;
- longevity of dredging (i.e. greater length of time before dredging is required to be repeated);
- practicality of dredging, especially where small to medium size cutter suction dredges can be used and proximity of suitable dredged sand placement sites;
- permanency of the entrance opening (i.e. entrance opening does not tend to close due to shoaling);
- environmental sensitivity (i.e. dredging and sand placement will have negligible to low environmental impact); and
- supports opportunities for the better utilisation of public waterfront land located at river entrances and within ports.

Maintenance dredging for navigation is important and at a number of our coastal entrances it has wide community benefits and supports and strengthens local and regional economies.

The following case studies demonstrate how the management approach adopted by Lands can achieve multiple outcomes for the benefit of all people of NSW.

### ***Case Studies***

#### *Clarence River Entrance at Yamba*

The lower Clarence River estuary provides facilities for commercial fishing vessels, charter boats and a range of recreational boating. Commercial fishing and recreational vessels utilising the Iluka boat harbour gain access via the main river channel. Vessels utilising the Yamba boat harbour facilities gain access via the Yamba entrance channel.

Since the development of the Clarence River as a sea port the construction and maintenance of river and port infrastructure in the lower Clarence River estuary has been undertaken through the expenditure of substantial public funds. The infrastructure, estimated to be worth around \$120 million, provides access and facilities for a range of commercial, charter and recreational vessels which in turn supports local and regional economies and a growing tourism industry.

The Clarence River is the home port to one of the largest commercial fishery in NSW. The industry is reported to support 370 jobs and generates an estimated \$27 million each year. The tourism industry is reported to be worth around \$190 million to the region (Clarence Valley Council, 2007). Maintaining safe boating access and navigation within the Clarence River entrance channels is considered vital and has wide community benefits.

Maintenance dredging of the entrance to Yamba channel last occurred in 2004. During that campaign approximately 9,000 cubic metres of marine sands were removed from the entrance and placed approximately 700 metres off Iluka Beach.



Recent hydrographic surveys of the waterway have quantified the extent of marine sand that has once again accumulated in the Yamba entrance channel. Reports from NSW Maritime Authority and local waterway users have indicated the extent of sand accumulation is affecting access and safe navigation for commercial fishing and recreational boats. Based on its investigations, Lands proposes to re-establish the navigational channel by undertaking a maintenance dredging campaign.

Extensive consultation with NSW Maritime Authority, Department of Primary Industries (Fisheries), Department of Environment & Climate Change, Clarence Valley Council and key waterway users and interest groups has resulted in the development of a dredging plan and sand placement strategy that achieves a number of positive benefits. A detailed environmental impact assessment report has been completed and demonstrates there are significant environmental, social and economic benefits for undertaking the proposed dredging campaign. Marine sand removed by the dredge will be utilised for renourishment of nearby beaches. Renourishment is considered highly desirable as the foreshore is currently retreating.

The dredging is expected to achieve multiple outcomes, including:

- Restoration of navigation channel;
- Minimal disruption to users of the waterway;
- Negligible environmental impacts;
- Beneficial placement and reuse of the dredge material within the coastal zone;
- Improved beach amenity and minimal disruption to beach users;
- Investment in the existing port and entrance infrastructure;
- Investment that supports local and regional economies and tourism;



**Figure 1:** Clarence River entrance and lower estuary.

## *Hastings River at Port Macquarie*

River and port infrastructure at the entrance to the Hasting River is estimated to be worth around \$40 million. The navigational channel leading from the Westport harbour area, along the Town Green foreshore to the river entrance provides access for a range of commercial fishing, charter and recreational vessels. Infrastructure along the Town Green foreshore provides safe berthing for a number of commercial and charter vessels while the Westport harbour area provides safe moorings for a range of recreational boats and government and emergency vessels.

The foreshore at the entrance to the Hastings River is considered an integral element for Port Macquarie as it provides the link between the CBD with the waterway. The foreshore and existing river/port infrastructure creates opportunities for an integrated leisure and recreation tourism precinct and which could include areas for commercial development, community interaction, water based leisure, public art and entertainment.

Maintaining safe boating access and navigation within the Hastings River entrance channel is considered vital and has wide community benefits. The Hasting River Estuary Processes Study suggests that marine sands have accumulated in the navigational channel between the Port Macquarie Town Green foreshore and Westport harbour areas (Port Macquarie-Hastings Council, 1998). The Department of Lands is investigating the benefits of dredging the channel.

The Town Beach Coastline Management Plan (Port Macquarie-Hastings Council, 2007) identifies a number of coastal erosion hazards and strategies to integrate effective management of long term coastal processes.

In consultation with Council and government agencies there is potential to place dredged sand on Town Beach for beach protection works i.e. dune renourishment.

The Department of Lands is exploring potential partners to assist financially with the proposed dredging campaign. Possible partnerships could be with State and local Government authorities and/or the private sector where there are clear mutual benefits.



**Figure 2:** Hastings River entrance and lower estuary.

### *Inner Harbour - Coffs Harbour*

The government's investment in port infrastructure at Coffs Harbour is worth over \$90 million. Coffs Harbour is situated midway between Sydney and Brisbane and offers marina berthing and associated facilities for a range of recreational power and sail boats. Coffs Harbour also supports a viable commercial fishing industry, provides facilities for Government and emergency vessels and has a number of maritime support services such as a slipway, marine engineering and chandlery businesses.

Infilling of the harbour with marine sands is an unfortunate consequence associated with the construction of the outer harbour walls. The harbour is a barrier to the littoral sand drift which greatly reduces any natural sand replenishment to the beaches immediately north of the harbour. Lord (1984) indicates that since 1942, the total rate of sediment trapped by the harbour is approximately 75,000 cubic metres per annum. Consequently, accretion of the harbour is a major issue and maintenance dredging of the entrance to the Inner Harbour is considered a priority to sustain the viability of the investment and the businesses that depend on reliable and safe access to the harbour.

While a number of dredging campaigns have occurred in the past, placement of the dredged sands in a manner and location that is acceptable in economic, social and environmental terms is becoming increasingly difficult and requires consultation and approvals from a number of stakeholders including the Marine Parks Authority and Coffs Harbour Council. Alternative strategies that are more expensive but socially and environmentally acceptable may involve the commercial sale of a portion of the dredge sand could be considered in the future to offset the cost of dredging.



**Figure 3:** Coffs Harbour

## *Wollongong, Ulladulla and Bermagui Boat Harbours*

The Department of Lands is actively pursuing the optimisation of Crown maritime assets at iconic ports along the NSW coast, such as Wollongong, Ulladulla and Bermagui, through a model which seeks to use private sector investment in adjacent Crown Land holdings to maintain and maximise the potential of these locations.

Port infrastructure at Wollongong (\$15M), Ulladulla (\$25M) and Bermagui (\$10M) has a total worth in the order of \$50 million. These ports are major features of the coastal landscape and are focal points for the community, visitors and tourists. There is increasing interest to revitalise these ports and adjacent coastal foreshores as significant destinations where locals and visitors can enjoy both the natural and historic elements and satisfy the demands for dining, recreation and leisure activities.

Historically, the ports on the south coast of NSW such as Wollongong, Ulladulla and Bermagui have only required dredging at infrequent intervals because of their natural characteristics which limit natural shoaling. However, should dredging be required, consideration would be given to these locations to support local and regional economies.



**Figure 4:** Wollongong Harbour

## Conclusion

To date, dredging to maintain vessel access in trained river entrances and minor ports has largely been responsive and ad hoc because there is no basis available to determine the relative priorities of competing locations and no clear definition of when the Government will undertake dredging. As a result any available funds could not be readily directed to locations where they may generate the greatest benefits.

The management approach adopted by the Department of Lands, as outlined in this paper, demonstrates how the limited resources available for maintenance dredging in the entrances to trained rivers and ports can be optimised.

Full funding of dredging at priority locations may not necessarily be forthcoming from the Department of Lands. Other innovative means of funding may need to be explored and may include contributions from the beneficiaries of the dredging and/or partnerships with other government authorities and programs.

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