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5. Land Contamination

5.1 Description of Existing Environmental Values

5.1.1 Introduction

An investigation was undertaken to identify potentially contaminated sites within the area of land affected by the project. The investigation focused on current and historical conditions for land within:

- Full Supply Level (FSL) area of additional land inundation;
- predicted 1 in 100 year ARI flood line; and
- area utilised for the expanded dam wall and construction activities.

The investigation included:

- search of Queensland EPA Environmental Management Register (EMR) and Contaminated Land Register (CLR) for property lots within the project- affected area;
- review of available historical aerial photography of the project area;
- consultation with knowledgeable long- term residents/ Park Rangers about potential contaminating activities in the affected area and guided visits (with those residents/ Ranger) to identified areas of potential concern;
- driving visual survey of the project- affected area; and
- boat visual survey of the Advancetown Lake shoreline.

Details of these activities and their relevant findings are summarised below.

5.1.2 EMR/CLR Searches

The principal sources of land-use planning data for contaminated land in Queensland are the Environmental Management Register (EMR) and Contaminated Land Register (CLR) databases administered by the Qld Environmental Protection Agency (EPA). The EMR is a land-use planning and management register for land that has been or is being used for a Notifiable Activity, and for which the EPA has been notified. The EMR provides information on historic and current land uses, including whether the land has been or is currently used for a Notifiable Activity, or has been contaminated by a hazardous contaminant. Notifiable Activities are those that cause or are likely to cause contamination. Schedule 2 of the EP Act identifies thirty-eight Notifiable Activities. The Notifiable activities identified as potentially occurring within the project-affected area are listed in **Table 5-1**

The EMR also provides 'Area Management Advice' (AMAs) regarding land areas where there is a potential for more widespread contamination from elevated metal concentrations due to natural mineralization or the possibility of unexploded ordnance (UXO) from Department of Defence training activities. An AMA is an administrative arrangement developed by the EPA, Local Government and other parties for land where detailed information is not available but alerts the community to information that aids in managing land contamination.

The CLR is a register of 'risk' properties which have been identified (through scientific investigation) as contaminated land which is causing or may cause serious environmental harm[1]. Land is recorded on the CLR when scientific investigation shows it is contaminated and action is required to remediate or manage the land.

[1] Environmental harm is defined in section 17 of the EP Act as environmental harm (other than environmental nuisance):
(a) that causes actual or potential harm to environmental values that is irreversible, of a high impact or widespread; or
(b) that causes actual or potential harm to environmental values of an area of high conservation value or special significance; or
(c) that causes actual or potential loss or damage to property of an amount of, or amounts totalling, more than the threshold amount; or

Table 5-1 Potential Notifiable Activities

Schedule 2 Notifiable Activity
Abrasive blasting
Chemical storage
Defence establishments or training areas
Drum reconditioning or recycling
Electrical transformers
Engine reconditioning works
Explosives production or storage
Gun, pistol or rifle range
landfill
Livestock dip or spray race operations
Pest control
Petroleum product or oil storage
Scrap yards
Wood treatment and preservation

It is important to note that the Registers do not provide a definitive list of contaminated or potentially contaminated properties. Thus the absence of a property from either Register does not necessarily mean that a property has not been used for a Notifiable Activity or another activity, which may result in contamination or is in fact contaminated.

The Registers record properties that are known to the EPA as being contaminated or have the potential for contamination because of an existing or past Notifiable Activity being undertaken on the property.

For this EIS, eighteen individual properties were identified as being at least partially within the project- affected areas. A search, conducted for all eighteen lots on the EPA registers (EMR and CLR) found that:

- None of the properties were listed on the CLR;
- None of the properties were listed on the EMR and
- There was no "Area Management Advice" regarding contaminated land for the area searched.

Search records for these properties are provided in **Appendix F.5.1**.

5.1.3 Aerial Photography Review

Historical aerial photography was reviewed to examine historical land use for any visible potentially contaminating activities. The dates (and scales) of photos reviewed were current (1:5000 and 10000), 1998 (1:25000), 1993 (1:25000), 1983 (1:40000), 1974 (1:12000 and 23900), 1969 (1:12000), and 1961 (1:16000).

The photographs show the continued rural land use history of the area –with farms and homes in the river valley lowlands transitioning to forested on the upper slopes. Following the construction of the Dam (Stage 1) in 1976, much of the valley area was inundated, with the rural land uses continuing at the end of the two inlet arms. No specific (potentially) contaminating activities (e.g. cattle dips, dump sites, etc.) could be identified on any of the photographs.

(d) that results in costs of more than the threshold amount being incurred in taking appropriate action to (i) prevent or minimise the harm; (ii) rehabilitate or restore the environment to its condition before the harm.

5.1.4 Consultation and Site Inspections

Interviews were conducted with several people who had long- term involvement and knowledge regarding the project area. Several potential contamination sites were identified. These discussions are summarised below. Approximate locations of these sites are shown on **Figure 5-1**

Laurie Fairall – GCW Senior Dam Ranger

Mr. Fairall has been Ranger at the Dam since 1990 and has worked undertaking weed control, reforestation, and maintenance activities extensively throughout the catchment. Based on his experience and recollections, he identified several potential contamination source sites within the project area and specified their approximate location on detailed current aerial photograph maps. Following these discussions, Ranger Victor Skilton accompanied Alliance staff to the specified locations to observe current conditions. Locations include:

Former home site with "bottle dump" – East Arm

Mr. Fairall described an old home site (now removed) and visible remains glass bottles) of what was apparently a home refuse disposal area. The area is now densely revegetated and not visible in aerial photography or from the Lake, nor any longer easily accessible. The exact location was not identified but, based on the Ranger's description, it may be within the proposed FSL inundation area and is likely to be within the 1 in 100 year ARI flood line.

Cattle Dip (1) – East Arm

Mr. Fairall described a concrete cattle dip structure on the top of a low hill above the East arm of the Lake. Associated fencing and other structures have reportedly been destroyed by fire. The dense revegetation obscures it from sight from aerial photography or from the Lake, and it was not located during an attempted walk- in. Based on the Ranger's description, it is within the 1 in 100 year ARI flood line and possibly within the proposed FSL inundation area.

"Black's Farm" and Cattle Dips – East Arm

An old farm (Black's Farm) was located at end of the East Arm, where the Little Nerang Creek approaches the Lake. The flat area of the property is currently used by Dreamworld to grow eucalyptus feed for koalas. Two cattle dips were described by the Ranger. One dip (cattle dip 2) was located on the hill to the west of the valley. It was viewed by Alliance staff and appeared to be more of a spray race than dip, and was located well above both the FSL inundation area and the 1 in 100 year ARI flood line. The other dip (cattle dip 3) was reportedly located close to the Creek, north of the planted eucalypt area. The riparian area is thickly covered in dense brush and the dip structure could not be found and exactly located during the site visit. Based on the Ranger's description, this dip would have been located well within the 1 in 100 year ARI flood line and the proposed FSL inundation area.

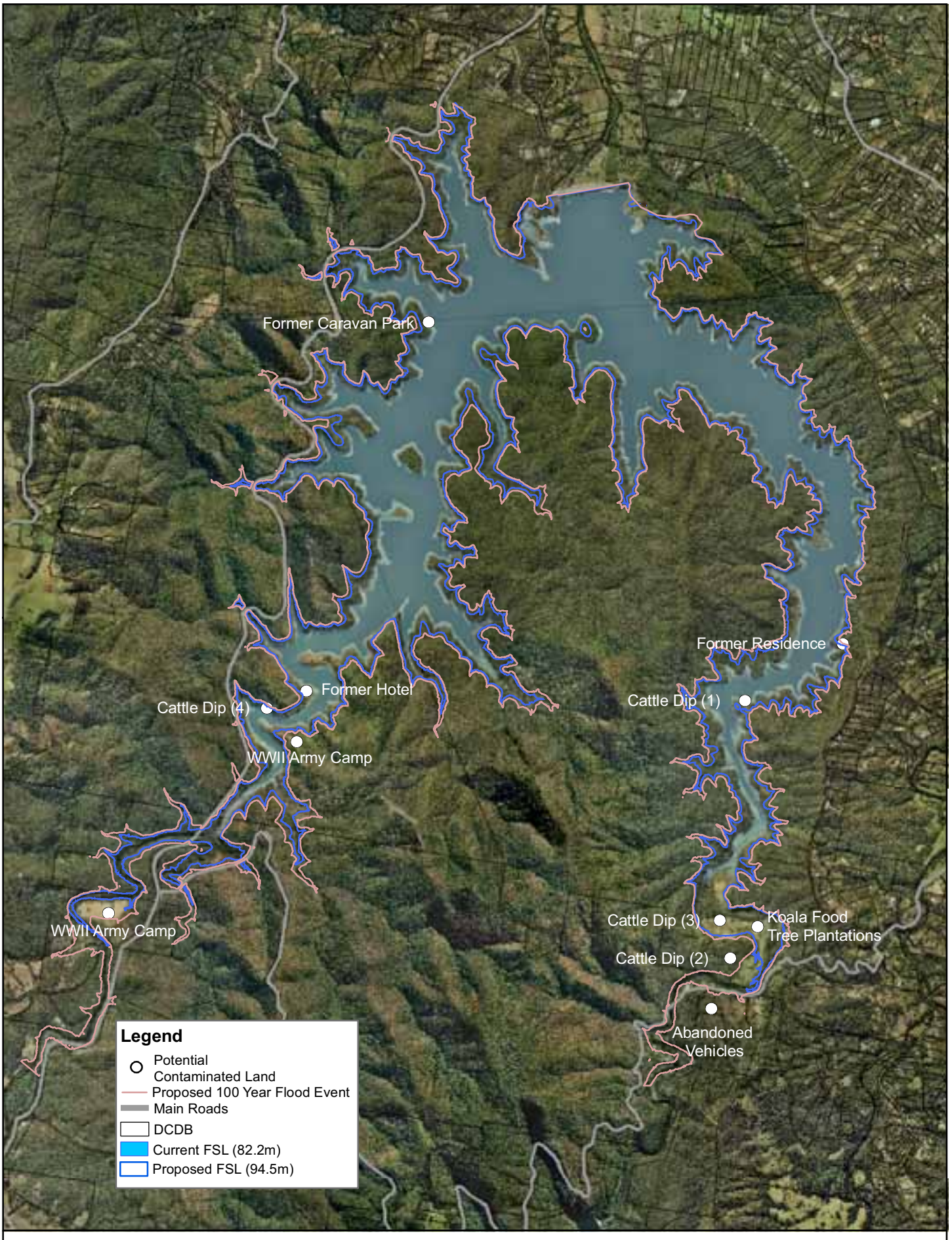
The koala fodder plantation consists of planted rows of eucalyptus tees, throughout this area. According to the Ranger, the herbicide "Roundup" (glyphosate) is utilised to control the grass along the base of the rows, which were observed to be bare.

Former "Sunflower Hotel" – West Arm

A hotel was once located along the West Arm valley. All evidence of the hotel is gone.. The Ranger reported a small "bottle dump" visible in the area which is now covered in high grass. According to the Ranger's description, the location will be within the 1 in 100 year ARI flood line and the proposed FSL inundation area.

Former Advancetown Caravan Park – West Arm

A caravan park, now completely removed, was once located along the West Arm valley. According to the Ranger, no visible indicators remain except for the contours of the terraced camping sites. According to the Ranger's description, the area would be inundated by the new FSL and be within the 1 in 100 year ARI flood line.



N

0 0.5 1 2

Kilometres

Scale - 1:50,000

Projection: MGA Zone 56

Figure 5-1

Potential Contaminated Land Locations

Hinze Dam Stage 3 EIS

Kenneth McKavanagh – Long- term resident

Mr. McKavanagh is a long- term resident of the area. His family's multi-generational farmlands (over a century) were located along the Western Arm on both sides of the Nerang River. He described land use history and accompanied Alliance staff to two areas of potential contamination concern in this area.

Cattle Dip 4– West Arm

Mr. McKavanagh's mother (Beris McKavanagh) grew up on family farm properties located near the junction of Pine Creek and Nerang River. His mother reported that they had a cattle dip between their house and the River. The farm and dip in that area was discontinued approximately 50-60 years ago. Mr. McKavanagh pointed out the approximate location from the West Arm boat ramp, but the location was inaccessible due to heavy vegetation. It is unknown whether this dip is located within the proposed FSL inundation area, 1 in 100 year ARI flood line, or potentially already inundated by the current FSL.

World War II Army Camps – West Arm

Mr. McKavanagh reported that the US Army had camped on their farms during World War II. One camp was on the east side of the Nerang River, on the slope below Page's Pinnacle. The other was in the level open field where a model airplane club is currently located. He reported that the Army left the land clean and his family had no complaints. Portions of these camps may be within the 1 in 100 year ARI flood line, but not within the proposed FSL inundation area.

Driving Visual Survey

Alliance staff inspected areas abutting all accessible roads around the Dam, including around the Dam wall and park land, the boat ramps, and the Nerang- Murwillumbah and Gold Coast- Springbrook Roads in the areas of the two inlet arms that may be affected by the project. No potential contamination issues were observed (other than described above) within the proposed FSL inundation area. One feature was observed within the 1 in 100 year ARI flood line near the south end of the East inlet arm. Across from the Ranger's house on the southern side of Gold Coast- Springbrook Road, there is a collection of abandoned scrap cars that may still contain residual oils, fuels, and car batteries.

Boat Visual Survey

Alliance staff accompanied the Ranger on a boat survey of the entire existing Lake. As the boat followed the shore line around the Lake, staff visually scanned the land, searching for any other signs of past or present human activity that might warrant further investigation. Other than the sites already identified by the Rangers (above), no additional sites of potential contamination concern were observed.

Summary

The investigation of contaminated land sites within the affected project area found the following potential concerns:

- three reported former cattle dip sites within the 1 in 100 year ARI flood line and/ or the proposed FSL inundation area, and one outside the 1 in 100 year ARI flood line;
- several old abandoned homes, a hotel, and a caravan park that may have had incidental associated refuse disposal nearby;
- two former World War II- era US Army camps;
- areas of active application of the herbicide "Roundup" (glyphosate) in the koala feed plantation areas; and
- one area with accumulated abandoned cars (with possible residual fuels, oils and car batteries) and an abandoned sawmill within the 1 in 100 year ARI flood line.

5.2 Potential Impacts and Mitigation Measures

Potential contaminated land related impacts from the project fall into two basic categories:

- *existing contamination:* Potential impacts from existing contamination within the project- affected area through increased contact/ exposure to the sites. This could include increased human contact during construction and/ or post construction activities, and possible human and aquatic ecosystem exposures if the site is permanently or periodically flooded, making the contaminants potentially available in the water column and sediments; or
- *potential future contamination:* Potential impacts of project construction, operation and maintenance activities that could cause releases of substances that could cause land to become contaminated.

Each of these categories is discussed below.

5.2.1 Existing Potentially Contaminated Sites and Impacts

Abandoned Home Sites, Hotel and Caravan Park

These locations show little evidence of their pre- dam human uses. However, there may have been locations of incidental disposal of refuse in these areas. Remnant "bottle dumps" are reportedly visible at the Hotel and home sites. There is no information regarding what may have been disposed of at the sites although it is likely wastes disposed from these activities would have included general household refuse (food scraps, paper, glass, etc.) and possibly small amounts of such items such as batteries, waste oils, cleaning products or paint containers, and other similar discarded household products. It was common practice in the pre- dam era to bury such general wastes near the point of origin in the rural environment.

These sites will not be disturbed by the project construction or by anticipated human activities within the catchment but may become inundated or periodically flooded. Whatever was disposed of at these sites has been buried for over 30 years. Of the materials disposed in these areas during that time, the organic - based wastes (including general household refuse and oils) will have biodegraded and/or naturally attenuated and therefore, are not considered to pose any significant risk to humans and/or the aquatic environment. The project therefore does not require further management/remediation with respect to these sites.

World War II Army Camps

Reportedly, the US Army had camped on farms in the project-affected area during World War II. One area was on the east side of the Nerang River, on the slope below Page's Pinnacle. The other was in the level open field where the model airplane club is currently located. No visible evidence remains from the Army camp. There is no information regarding specific activities conducted at the camps, however they would likely have included generation and possible burial of similar general wastes as described above, as well as possibly maintenance wastes (e.g. oils). It is unknown if there was any storage or use of ordnance in the camps, but the area is not identified as an area of potential unexploded ordnance (UXO) on Defence's UXO information website www.defence.gov.au/uxo. The model airplane club has operated in the former camp field without incident.

These sites will not be disturbed by the project construction nor will they be subject to increased human activity thereafter. The sites are not within the FSL inundation area but are within the 1 in 100 year ARI flood line and portions may be periodically flooded. Whatever was disposed of at these sites has been buried for over 60 years. Of the materials disposed in these areas during that time, the organic - based wastes (including general household refuse and oils) will have biodegraded and/or naturally attenuated and therefore, are not considered to pose any significant risk to humans and/or the aquatic environment. The project therefore does not require further management/remediation with respect to these sites.

Herbicide Application Areas

The herbicide "Roundup" (glyphosate) has been actively used to control grass and weed beneath the row of eucalyptus trees in the koala fodder growing areas. This operation is still continuing and there is likely to be some

remnant glyphosate in the soils from recent applications. These areas include locations that will be permanently or periodically subject to inundation. Glyphosate is considered only slightly mobile, tending to bind to the soil, bonding particularly strongly to clay. It is considered to have low toxicity to upland and aquatic species. It has a reported field dissipation half life of about 44 days. [2]

This practice is unlikely to have any significant or long - term impact on water quality or the catchment ecosystem. Application of the herbicide will cease in the inundation areas prior to inundation.

Scrap Car Yard

This site is located within the 1 in 100 year ARI flood line. Any oils and/ or fuels that may remain in the car bodies could enter the dam waters if they become flooded in a major flood event. Additionally, the deterioration of car bodies and leakage from deteriorating car batteries could add to the metal concentrations in the dam water. As the rate of such impacts is largely uncontrollable due to a number of uncharacterised influences, the preferred management option for this type of impact is removal of the source material.

Cattle Dips

Four cattle dips were reported to be located within the project area. The dips are no longer in use and have been obscured by regrowth of vegetation. The history of their use, particularly with respect to the type of chemicals used, is not known.

In terms of land contamination, one of the most significant impacts from cattle farming is the use of cattle dips to control cattle ticks. Cattle dips were first introduced in the 1890's and their use has continued to the present (albeit limited) for this purpose. Cattle ticks are controlled by dipping cattle into a bath containing pesticides or tickicides. Since the introduction of cattle dips, a range of tickicides have been used. These have principally included Arsenic, Organochlorine Pesticides (OCs), for example DDT, and Organophosphorus Pesticides (OPs). **Table 5-2** summarises the types of pesticides which have been historically used in Cattle Dips.

Table 5-2 Pesticides Historically Used in Cattle Dips

Pesticide (Tickicide)	Period of Use
Arsenic (Trioxide)	pre 1900's to 1955
DDT	1955-1962
BHC	1955-1962
Carbaryl	1693-1970
Caoumpahos	1962-1970
Carophenothion	1962
Bromos ethyl	1969-1974
Dioxothion	1969
Ethion	1962-1976
Chlordimeform	1973-1976
Amitraz	1976-present
Promacyl	1977-1992
Cypermethrin + Chlorfenvinphos	1979-present
Flumethrin	1986-present

Source: Kimber S., etal (2002), *Is there evidence of arsenic movement at cattle tick dip sites?* , Australian Journal of Soil Research, Vol.40 p.1103-1114.
Source: NSW Agriculture (1996), Guidelines for the Assessment and Cleanup of Cattle Tick Dip Sites for Residential Purposes.

[2] Half life is defined as the amount of time, under usual environmental conditions, for half of the concentration of a substance to be degraded. This is iterative so that 50% of the original concentration would be gone in 44 days, 75% in 88 days, 87.5% in 132 days, etc. Reference: J Schuette Environmental Fate of Glyphosate. 1998, Environmental Monitoring and Pest Management, Dept. of Pesticide Regulation, Sacramento, CA, USA.

Arsenic was first used for cattle tick control up from the 1800s until about 1955. OCs (such as DDT) were used between about 1955 and 1962. OCs are characterised by low-water solubility and form strong bonds with soil and their rate of breakdown is normally slow with a half-life in soil of more than 20 years They are moderately toxic across a broad range of organisms and bioaccumulate and biomagnify up the food chain. OPs were introduced in the 1950's and their use continues to this day. Although OPs can be persistent through strong adsorption to soil particles, they are generally considered to be less persistent than OCs[3]. Chemicals used such as synthetic pyrethroids (eg. Cypermethrin), Carbamates (e.g. Carbaryl) as well as others may have been used. Chemicals used today typically breakdown more readily and are consequently less likely to accumulate in soils.

Potential areas of soil contamination from cattle dips are described in the Guidelines for the Assessment and Cleanup of Cattle Tick Dip Sites for Residential Purposes (NSW Agriculture 1996). These areas principally include:

- drips from cattle in yards;
- leakage from the bath;
- disposal of waste liquid and sludge (usually through dumping adjacent to bath);
- areas where splashing from cattle entering, exiting and moving through the bath;
- storage and mixing areas for chemicals; and
- drainage paths.

The lateral and vertical extent of contamination around a dip depends on a range of site specific factors. Examples of these include cattle dip design, soil types, site gradient, operating practices and age and frequency of use.

Highest concentrations of contaminants are usually found adjacent to the bath and crush and in liquid and sludge disposal areas (NSW Agriculture 1996). The lateral extent of most of the contamination is usually confined to within about 5m of the edges of the bath and drip yard. Where the site slopes away by more than 5°, contamination can extend further down gradient to about 30m. The vertical extent of contamination is generally limited to within the top 0.5m of soil around the bath and drip yard. Sandy soils typically result in deeper contamination. High levels of arsenic and OCs can persist for many years following cessation of dipping operations.

Contaminated dip sites within the proposed FSL have the potential to impact on the aquatic organisms and water quality within the dam. Once inundated, contaminated soils from these sites will become sediments within the dam. The effects of contaminated soil left unabated on water and organisms within the dam is difficult to predict. The release of contaminants is a complex process involving aspects such as contaminant levels, speciation (form the contaminant is in), soil type, redox conditions, pH, oxygen levels, water depth, light penetration, sediment biota and many others.

Contaminated dip sites which are located outside the FSL also have the potential to impact on water quality and organisms within the dam. Impacts could be potentially associated with the erosion and deposition of contaminated soils into the dam or the leaching of contaminants into groundwater and their subsequent movement into the dam. It is anticipated, however that impacts would be of a lesser significance than sites within the full supply level due to the lesser degree of exposure of the contaminants to water.

The impact of contaminated dip sites outside the FSL on water quality would be influenced by a range of factors. Some of these could include:

- distance from full supply level
- erosion potential (ground cover and soil stability); or
- contaminant leaching potential.

[3] NSW Agriculture (1996), Guidelines for the Assessment and Cleanup of Cattle Tick Dip Sites for Residential Purposes.

Other impacts associated with contaminated sites outside the FSL include potentially restricting uses (e.g. recreational) due to the potential for human contact with contaminants.

The reported locations of the dip sites within the project area include one definite site within the proposed FSL, two more sites potentially within the proposed FSL and definitely within the 1 in 100 year ARI flood line, and one site on a hill outside the 1 in 100 year ARI flood line.

5.2.2 Proposed Mitigation Measures

Management of contaminated land in Queensland is regulated by the *Environmental Protection Act 1994* (EP Act) and subordinate policies and regulations. Methodologies are based largely on the following Australian guideline publications:

- the Australian Standard AS4482.1-1997 Guide to the sampling and investigation of potentially contaminated soil Part 1:Non-volatile and semi-volatile compounds (Standards Australia 1997);
- the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) (National Environment Protection Council [NEPC] 1999); and
- Qld Department of Environment and Heritage (now Environmental Protection Agency) *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*, May 1998 (Department of Environment [DoE] 1998).

These documents provide a framework for assessing and managing contaminated soil and/or groundwater based on an evaluation of three related items.

- contamination: Soil and/or groundwater contamination must be present. Contamination is the release of a hazardous contaminant into the environment that is likely to cause serious or material environmental harm because of its physical, chemical, infectious characteristics or concentration;
- receptors: Humans and/or a receiving environment must be present and be potentially impacted by the identified contaminants;
- pathways: The contamination must be able to contact receptors by means such as:
  - humans – ingestion, skin contact, inhalation; and
  - environment – seepage into waterways, wind-blown deposition on plants, root uptake, ingestion, skin contact and inhalation by various life forms.

For a contamination risk to exist, each of these items in the 'risk chain' must be linked.

To ensure that contaminated sites are thoroughly assessed, the Qld EPA Draft Guidelines provide information on how contaminated sites investigations are to be progressively managed through a staged approach, in accordance with national guidelines. These stages include:

- stage 1 — Preliminary site investigation;
- stage 2 — Detailed site investigation;
- stage 3 — Health and environmental assessment and determination of remediation plan; and
- stage 4 — Implementation of agreed remediation plan and validation sampling.

A brief summary of each stage is provided below:

Stage 1 - Preliminary Site Investigation

A preliminary site investigation includes the following components:

- development of a site history;
- EPA register searches;
- an inspection of the site;
- a basic sampling program to determine if contamination is present; and
- report preparation.

The most important part of a preliminary site investigation is the preparation of a comprehensive site history to identify all past and present potentially contaminating activities. Sometimes Stage 1 and 2 investigations are often combined.

Stage 2 - Detailed Site Investigation

A detailed site investigation is required when the results of preliminary site investigation indicate potential or actual contamination. The detailed site investigation should delineate the lateral and vertical extent of contamination, and provide information about:

- maximum and average concentrations of the various contaminants,
- volumes of soil requiring remediation,
- leachability and mobility of contaminants,
- potential for groundwater contamination, and
- possibility of off-site migration through soil, surface water or groundwater.

The decision on how to proceed in the second stage of investigation requires professional judgement of the site-specific issues and is dependent on the findings of the preliminary investigation.

Stage 3 - Health and Environmental Assessment and Determination of Remediation / Management Plan

Assessment of Risk

The results obtained from the detailed site investigation are used to determine the potential human exposure and environmental impact of the contaminants on the current and proposed land uses.

Remediation and/ or Site Management

When results of a contaminated site investigation indicate that remediation is required, a remediation plan is prepared. The draft remediation plans may include a request for a disposal permit in accordance with the requirements of the EP Act, if necessary, to remove contaminants from the site. Contaminated soil must not be removed from a site without a disposal permit.

In some cases, contamination associated risks can be safely managed on- site. Specific procedures for this management are detailed in a Site Management Plan (SMP), including construction, maintenance, and long term monitoring. Approval for this SMP can be sought from the EPA.

Many cattle dip sites in Queensland have been effectively assessed and managed according to this process, including cattle dip sites located within other dam inundation areas. Typical mitigation options include:

- do nothing (contaminated site left as is if results of site investigation and assessment of risk determines no action necessary);

- on-site treatment/remediation to reduce contamination;
- capping of contaminated sites, in place;
- excavation and off-site disposal to landfill/ monocell disposal facility; and
- excavation and on-site disposal to a suitable location within the project area, with appropriate engineered controls (e.g. liner, cap).

It should be noted that leaving or managing contamination on- site will result in the parcel of land being placed on the EPA EMR.

The most recent precedent for the remediation of contaminated sites for a dam project in Queensland is the Awoonga Dam Raising project. The Awoonga Alliance made a decision to place a clay cap over selected cattle dip sites within the affected area based on a qualitative risk assessment. No contaminated material was treated or removed from these locations. The identification of sites requiring remediation was based on the ANZECC 2000 sediment guidelines.

The Hinze Dam Alliance will conduct site investigations and assessments of these dip sites to determine the need for mitigating actions. Investigation, assessment and management of contaminated sites will be undertaken in cooperation with EPA's Contaminated Land Unit and in accordance with the Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (DEH 1998), NEPM and national water quality criteria. All investigations will be carried out by a suitably- qualified investigator in accordance with requirements of the EP Act (1994). Site investigation reports will be submitted with a statutory declaration by the investigator as required by the EPA. All work will also be subject to review and approval by an EPA- approved Third Party Reviewer (TPR). Based on these reports and TPR advice, the EPA will determine when the health and environmental risks associated with the sites have been appropriately addressed and managed.

All required remediation and/ or site management will be completed and approved prior to the raising of dam water levels. Any required long- term monitoring will provided for in the dam's operation plans.

5.3 Potential Contamination Impacts - Construction and Operation

Land contamination could potentially result from the spillage or on- site disposal of hazardous materials or wastes used in the construction and/or operation of the dam. Project materials and wastes will be managed in a manner that will prevent such contamination. It is the specific intention of the Alliance that project construction and operation activities will not cause contamination that will result in the land requiring listing on the EPA's Contaminated Land Register. Project waste streams and their planned management are detailed in **Section 15**. Procedures for the proper storage and management of hazardous materials are detailed in the EMP (**Section 19**) and the Emergency Management Plan (**Section 19**)

Chemicals, fuels, oils and any other substances that, if spilled would cause pollution or contamination of the land or water, will be stored appropriately to minimise the risk of environmental impact. Chemical storage will comply with Australian Standards and Material Safety Data Sheets (MSDS) requirements. MSDS for products kept on site will be readily available to employees and contractors.

Smaller quantities of chemicals, fuels and oils will be stored in self bunded pallets, within a bunded area in the workshop, or in a bunded container on the site. Diesel will be kept in bulk quantities (up to 130 000 L) in double skinned tanks (self bunding).

Waste products, (e.g oil/water separator waste, sludges and residues), will be contained within weatherproofed, sealed and bunded areas to ensure stability of the waste containment receptacles and prevent any leakages or spills causing environmental harm to soils, surface water or groundwater. Regular inspections will be carried out of the tanks, bunds and storage areas to ensure integrity.

Standard procedures for the storage, handling, disposal and spill response for potentially hazardous waste materials will follow the Emergency Management Plan. In the event of a large spill, sites will be investigated, managed and remediated in accordance with the requirements of the contaminated land provisions of the EP Act and the QLD EPA Draft Guidelines. Following remediation of these spills, validation sampling will be conducted to verify that remediation is successful.

5.4 Summary

The investigation of contaminated land sites within the affected project area identified potential contamination concerns from three reported former cattle dip sites within the 1 in 100 year ARI flood line and/ or the proposed FSL inundation area, and one site outside the 1 in 100 year ARI flood line. The Alliance will conduct site investigations and assessments of these dip sites, in accordance with these policies and regulations, to determine the mitigating actions required to ensure water quality in Advancetown Lake is maintained. Investigation, assessment and management of contaminated sites will be undertaken in cooperation with EPA's Contaminated Land Unit and in accordance with all relevant legislation and policies.

All required remediation and/ or site management will be completed and approved prior to the raising of dam water levels. Any required long- term monitoring will provided for in the dam's operation plans.

Project materials and wastes will be managed in a manner that will prevent land contamination that could potentially result from the spillage or on- site disposal of hazardous materials or wastes used in the construction and/or operation of the dam. It is the specific intention of the Alliance that project construction and operation activities will not result in contamination.